Body of European Regulators for Electronic Communications

BEREC

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Differentiation practices and related competition issues in the scope of net neutrality

Final report

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Executive summary

(1) In the last decade, people, the economy and our societies have greatly benefited from the growth in both internet connectivity and content and applications available to them. This growth has, so far, largely relied on the so-called best-effort internet.

(2) In the last few years, some ISPs have begun to move away from pure best efforts and started to introduce some degree of prioritisation – i.e. by introducing specialised services or managing traffic of capacity-hungry applications such as peer-to-peer (P2P). In some cases, other practices have arisen such as blocking or shaping traffic from certain applications, e.g. VoIP. All of these developments are spurring a debate about their implications for the future development of the internet.

(3) The net neutrality debate that has emerged over the course of the last decade at the initiative of content and application providers (CAPs) and internet users is about whether these developments may be against their interest. More precisely, under what circumstances could these developments raise users' concerns?

(4) Among others, the following concerns have been suggested:

- the development of premium-priced priority internet access offers, which would allow operators to not only (a) better meet demand from users and CAPs but also (b) extract value from bandwidth scarcity, could reduce incentives to invest in new capacities (reducing best-effort internet to a so-called 'dirt road');
- the development of applications or protocols that block or reduce the possibilities of development of new services on the internet, and that may lead to the situation that purchasing a 'plain internet' access offer could in the end prove to be too expensive for the average citizen;
- the hindering of services by ISPs vertically integrated with CAPs, with the risk of increased development of 'walled gardens', reducing the possibilities for 'one man in a garage' to create new successful services;
- the development of bilateral agreements between ISPs and CAPs for the prioritisation of the CAP's content on the ISP's network, with the risk of evolving toward a two-speed internet, where only big and already existing CAPs can reach the user with a good quality of service, hence limiting the opportunities for new entrant CAPs and the 'man in the garage'.

(5) In BEREC's response to the European Commission's consultation on the open internet and net neutrality in Europe,[1] net neutrality was described as follows:

> 'A literal interpretation of network neutrality, for working purposes, is the principle that all electronic communication passing through a network is treated equally. That all communication is treated equally means that it is treated independent of (i) content, (ii) application, (iii) service, (iv) device, (v) sender address, and (vi) receiver address. Sender and receiver address implies that the treatment is independent of user and content/application/service provider.
>
> 'There have been and will continue to be deviations from this strict interpretation. Some of these deviations may well be justified and in the interests of users but

[1] BoR (10) 42 of 30 September 2010.

other forms could cause concern for competition and society. To assess this, NRAs will need to consider a wider set of principles and regulatory objectives'.

(6) This description of net neutrality is very close to the situation in a world of widespread pure best efforts, even if best efforts and net neutrality are not exact synonyms. We continue to use this definition as a useful working benchmark for the purposes of this report.

Context: legal environment and BEREC policy background

(7) The European regulatory framework assigns a responsibility to NRAs, in ensuring the efficient operation of electronic communication networks in general, and the internet in particular, taking into account the principle of net neutrality, as well as the various restrictions weighing on market players. To meet this responsibility, BEREC has set itself the task of identifying and promoting rules and best practices that apply regardless of network technology, in a manner that is fair to all of the different stakeholders, and acknowledging that this topic has a dual dimension: technical-economic and social responsibility. In this regard, the following consideration (in recital (5) of the Framework Directive) should be borne in mind: '*The separation between the regulation of transmission and the regulation of content does not prejudice the taking into account of the links between them, in particular in order to guarantee media pluralism, cultural diversity and consumer protection*'.

(8) More specific demands are contained in the new telecom package that was adopted in December 2009, where more emphasis is given to symmetrical regulation, providing NRAs with more wide-reaching objectives and tools than before for achieving a threefold goal (as reflected in Article 8 of the Framework Directive):

- To achieve the overarching objective of guaranteeing access to content for the interest of the citizens of the European Union: '*promoting the ability of users to access and distribute information or run applications and services of their choice*' (Art. 8 § 4.g).
- To ensure that electronic communications networks run smoothly, in other words to guarantee a satisfactory quality of service; this is covered by traditional objectives falling on NRAs, notably: '*ensuring that the integrity and security of public communication networks are maintained*' (Art. 8 § 4.f) and '*encouraging […] the interoperability of pan-European services, and end-to-end connectivity*' (Art. 8 § 3.b). The new power to set a minimum quality of service (see hereunder) may also be viewed in this light.
- To enable the long-term development of the networks and services through innovation and the development of the most efficient technical and business models; competition plays a fundamental role here, hence the importance of NRAs' objective of '*ensuring that there is no distortion or restriction of competition in the electronic communications sector, including the transmission of content*' (Art. 8 § 2.b).

(9) In its response to the Commission's 2010 public consultation,[2] BEREC had already started analysing the reach and implementation possibilities of relevant tools in the framework to address net neutrality issues (including, inter alia, Article 5 of the Access Directive, or disputes settlement in Article 20 of the Framework Directive). Two areas were most recently investigated by BEREC:

- The obligations to be transparent with users about any possible restrictions on usage, or traffic management techniques, implemented by network operators (Arts. 20 and 21 of the amended Universal Service Directive, USD). See BEREC 'Guidelines on transparency in the scope of net neutrality' published in December 2011.
- A new power to set a minimum quality of service, overseen by the Commission, '*in order to prevent the degradation of service and the hindering or slowing down of traffic over networks*', due in particular to certain traffic management practices, in accordance with Article 22 of the amended USD. This was the subject of a first 'Framework Report' adopted by BEREC in 2011, which is to be followed by Guidelines in 2012. One aspect the latter will consider in particular is to what extent the provision suggests that quality of service does not pertain only to the users' point of view, but also includes the terms extended to CAPs for routing their traffic. Recital (34) associated with this clause (in the Citizen's Rights Directive amending USD) notably stipulates that '*those procedures should be subject to scrutiny by the national regulatory authorities, acting in accordance with the Framework Directive and the Specific Directives, and in particular by addressing discriminatory behaviour*'.

(10) This last reference illustrates one of the many links between the different aspects of the net neutrality work streams, and in particular the concern about 'discrimination' that is considered in this report. Bearing in mind those links, this report will further develop BEREC analysis with respect to the various objectives set out below, in particular by assessing the static and dynamic impact of potential differentiation practices by ISPs.

Approach of the report

(11) This report examines and assesses the potential impact on users of departures from net neutrality at the initiative of ISPs. We define a differentiation practice as any decision of ISPs or any agreements between ISPs and CAPs or ISPs and users entailing that some traffic from or to some CAPs or users, or related to specific application or protocol, is treated differently – i.e. slowed, accelerated or blocked – from those of other CAPs or users or other applications or protocols. These differentiation practices could include situations in which CAPs are charged. This report examines which differentiation practices may or may not in principle harm the user's interest and have a negative impact on competition and innovation, both in

[2] BEREC "*Response to the European's Commission consultation on the open internet and net neutrality in Europe*" was adopted on 30 September 2010.

electronic communications markets ('networks') and in content,[3] application and services markets ('content'). In doing so, it aims to provide a conceptual framework for assessing potential user harm concerns and identifies the main elements of such assessment.

(12) The potential effects on users include both static and short-term impacts and the longer-term dynamic implications. The former capture the impacts on users in terms of prices and quality of their current internet connection and of the content and applications services that are available today. Dynamic impacts consider the incentives to invest and innovate in the different parts of the value chain. In particular, it considers the impact of differentiation practices on the incentives to invest and innovate of the various parties. This will ultimately have an impact on users. In this respect, the specific characteristics of the internet should carefully be taken into account, in particular the open platform aspect (e.g. 'universal connectivity', 'very low entry cost', 'usage agnostic' or 'separation of network and applications layers', 'innovation without permission') and network externalities.

(13) Upholding the principle of neutrality concerns all of the players involved in the 'internet chain', whether the parties operating electronic communications networks routing internet traffic, or the many and various providers of services in the information society. Given this, some of the questions raised in the debate around net neutrality fall outside the realm of the rules and regulations that apply only to electronic communication networks. These networks nevertheless occupy a central place on the 'internet chain' and among the players that populate it. Indeed, the entities that operate these networks have a special responsibility because of their essential function of routing traffic between users. ISPs are therefore the first ones affected by the demand for neutrality.

(14) In this report we focus on differentiation practices that are instigated by ISPs. This is to say that we do not examine differentiation practices that are imposed on ISPs by legal requirements, whose relevance and legitimacy are out of the scope of this report. Nevertheless, this does not preclude us from considering the way in which such requirements are implemented, since the specific technique chosen by an operator may not be appropriate with regard to the fulfilment of the abovementioned objectives.

(15) BEREC acknowledges that, beyond the considerations highlighted above (competition, innovation and harm to users interest), there are other aspects, which are a part of this debate, e.g. issues related to freedom of speech or access to certain type of content which may be deemed socially useful. For instance, BEREC mentioned in its response to the public consultation of the Commission that '*There have also been some concerns expressed relating to the effective exercise of fundamental rights and freedoms such as freedom of expression or privacy, that could arise if operators were to give preferential treatment to some kinds of data flows*'. These considerations are not the focus of the report, and should be examined in the light of relevant legislation.

[3] The need for NRAs to consider impact on innovation at both ISP and CAP level is also underlined in the regulatory framework; see, for instance, Recital (8) of the Better Regulation Directive (amending the Framework Directive and the Specific Directives): "*In order to achieve the goals of the Lisbon Agenda, it is necessary to give appropriate incentives for investment in new high-speed networks that will support innovation in content-rich internet services and strengthen the international competitiveness of the European Union*".

Framework to analyse differentiation practices

(16) In this document, BEREC proposes a conceptual framework to analyse differentiation practices, applying it to concrete examples. This analysis is based on the potential effects of the practices on users, either directly (through the impossibility of using some services) or indirectly (through, for example, a reduction in alternative choices).

(17) The proposed analysis covers:

- ISPs' incentives to discriminate (basically based on revenue maximisation through their vertical integration or cost minimisation in the absence of any vertical integration).
- The ISPs' ability to perform the discriminatory practices in a sustainable manner despite users' possible reaction, which depends, among other things, on their position in the market.
- Finally, the dynamic and static effects of these practices, acknowledging the particular features of the internet 'ecosystem'. As stated above, owing to network effects of the internet, any restriction could create entry barriers either for users or, in particular, for CAPs, interrupting this virtuous circle and affecting future consumer welfare.

(18) The above framework has been applied to example cases to test it and try to obtain more general lessons that could be applied in other situations that could arise in the future. Therefore, the purpose of these examples is not to provide definitive answers – these can be reached only in specific cases and examining the evidence available – but to try to identify what are likely to be the key elements of any competition analysis.

(19) According to the data gathered by BEREC, most of ISPs offer internet access with no application-specific restrictions. However, specific practices (such as blocking or throttling of P2P traffic or VoIP) more often occur in the mobile network than the fixed network sector.

(20) Accordingly, the practices considered are:

- VoIP blocking on mobile internet access service;
- P2P blocking on fixed internet access service;
- differentiation in the conveyance of traffic of CAPs (quality and/or price).

Main findings

(21) Vertical integration gives ISPs incentives to implement differentiation practices, as they could reduce competitive pressure on their own retail services. The paradigmatic example of this is VoIP, where ISPs are providing voice calls through the traditional fixed or mobile network, while users could find substitutes on the internet (maybe not perfect substitutes but at least viable substitutes for some types of calls) at lower prices (even for free). Indeed, this practice is one of the most widespread, according to the data gathered by BEREC.

(22) As this differentiation has the aim of foreclosing, the effects on users are high because these practices have both static and dynamic effects. The less the competition, the higher the prices, and, in addition, restrictions on CAPs could have effects in the long run of limiting their growth by reducing their potential demand.

(23) In those cases where the ISP providing users with internet acces (internet access provider, IAP) is not vertically integrated, potential differentiation practices could affect content and applications not provided by the operator. In these cases, the rationality behind such practice is either cost reduction (understood in broad terms such as network costs, but also congestion management) or income increase. Traffic management could have the aim to move from the current *'no commercial relation practice'* between CAPs and IAPs to a scenario where the IAP starts charging CAPs, in order to increase the total income of their operations.

(24) BEREC has acknowledged that IAPs should have the opportunity to manage their networks to increase efficiency, minimising the resources needed to provide the service and assuring the best deal to all users. It is important to note that congestion has some hidden costs that are difficult to measure, as it affects all users connected to the network. In this sense, a fair traffic management could enhance welfare.

(25) These arguments are valid only if the restrictions are done on a non-discriminatory basis among all content and applications providers, and according to objective criteria such as consumption of resources. In other cases, the rationale behind the IAPs' behaviour could be distortion of competition.

(26) It is important to bear in mind that it could be also the case that IAPs opt to restrict or block, in broad terms, the content accessible by users from their connections. In this case, the above conclusions might not be valid because the final outcome of taking all restrictions together is harm to users by reducing the available choice from their connections. This could be especially problematic in an environment where IAPs tend to block or degrade applications or CAPs on a general basis, including when, for example, a particular IAP blocks a specific application or CAP, another IAP blocks a different application or CAP, and so on. In this context, current internet features would be very difficult to maintain, affecting users' welfare.

(27) The report has, nevertheless, identified some key elements that could potentially deter IAPs from implementing differentiation practices that harm users:

- Competition observed at retail level. NRAs have tools under the current framework to enhance competition and prevent the strengthening of significant market power (SMP) positions. Any measure aimed at forbidding an anticompetitive practice would be a second best compared with a scenario where the market develops in an effectively competitive manner.
- Consumer awareness, market transparency and low switching costs. The sustainability of restrictive practices would depend on consumer awareness of differentiation practices and their possibilities for exerting pressure on the IAPs by their purchasing decisions. The more easily a consumer could detect a restrictive practice and change its IAP, the stronger the pressure on IAPs to reduce unfair and discriminatory practices.

(28) Finally, when retail competition is not enough to grant an adequate output for end users (which does not need to be exactly the same as the one observed today), NRAs have different ways to deal with specific behaviours of the IAPs.

(29) In the presence of a SMP operator, regulation under the common regulatory framework of electronic communications networks and services and competition law has tools to address some potential problems.

(30) In addition, the revision of the existing Directives has granted additional tools to NRAs, e.g. in the form of minimum quality requirements, which could – on the basis

of the decision taken by the NRA considering the particular circumstances of the case – be applied to operators, independent of SMP in the retail market. Resorting to QoS provisions appears to be an effective action in a situation where, even absent SMP, discriminatory practices that do not have any legitimate objective and fair rationality become more frequent.[4] In this case, users' connections may be degraded by such practices and future innovation might be discouraged. Application of the QoS provisions could also be relevant in presence of SMP operators, as a complementary remedy to pro-competition tools, taking into account that the practices undertaken by the SMP operator(s) could be those that have been deemed particularly detrimental for the development of competition, in particular in instances of foreclosure. Imposing minimum quality requirements should come only after a thorough analysis of the practices and their situation in the context of a market, which are detailed in BEREC's *Guidelines for quality of service in the scope of net neutrality*.

[4] The mediation by NRAs in conflicts arising between electronic communications operators and CAPs may also be an option, on a case-by-case basis, when on the basis of national law NRAs have been granted the possibility to intervene to solve such cases through dispute settlement procedures.

1 Introduction

(31) In the last decade, people, the economy and our societies have greatly benefited from the growth in internet connectivity and content and applications available to them. This growth has, so far, largely relied on the so called best-effort internet.

(32) In the last few years, some ISPs have begun to move away from pure best efforts and started to introduce some degree of prioritisation, e.g. by introducing specialised services or managing traffic of capacity-hungry applications such as peer-to-peer (P2P). In some cases, other practices have arisen such as blocking or shaping traffic from certain applications e.g. VoIP. All of these developments are spurring a debate about their implications for the future development of the internet.

(33) Further complexity is brought into this debate through considerations on long-term innovation and fundamental freedom and their link with unrestricted access to 'the internet'. Leveraging on the fundamental role of competition, the revised framework puts forward the tools to make this competition effective, addressing market failures and empowering the customer (representing the demand side of this 'two-sided market'). It also explicitly emphasises the need for NRAs to promote 'the ability of users to access and distribute information or run applications and services of their choice'.

(34) In responding to the Commission 2010 consultation, stakeholders referred to identification and economic assessment of traffic management rules as the major issue regarding net neutrality. Prioritisation implicitly has the consequence of discrimination, but a number of aspects should be taken into account to evaluate possible negative consequences for the level of competition, innovation and the interests of users. In 2011, BEREC initiated an economic analysis of the potential and theoretical effects of discriminatory behaviour.

(35) The result of this analysis is this report, which is organised as follows:

(36) First, we set the wider context by discussing how the internet is currently organised, including recent and likely future trends. We also examine the value chain that applies to the internet ecosystem (Chapter 2).

(37) Second, we describe the possible reasons that may lead ISPs to introduce differentiated practices. We have classified them as ranging from legitimate motivations – i.e. to fulfil legal requirements or to ensure network security and integrity – to motivations that may be more difficult to classify in relation to their effects – i.e. providing differentiated services to users or CAPs or protecting existing services. Then we describe the kind of direct and indirect effects that may be produced by these practices (Chapter 3).

(38) Third, we provide an analytical framework for assessing the possible impact on end-users of various differentiation practices (Chapter 4).

(39) Fourth, we consider some illustrative differentiation practices to which we apply the above analytical framework. We have identified a number of practices and we assess their impact (Chapter 5).

(40) Finally, we try to draw some conclusions and identify the key themes that have arisen from the discussion of the analytical framework. We also raise some issues relating to the remedies available to NRAs (Chapter 6).

2 The Internet value chain

2.1 Context and recent evolutions

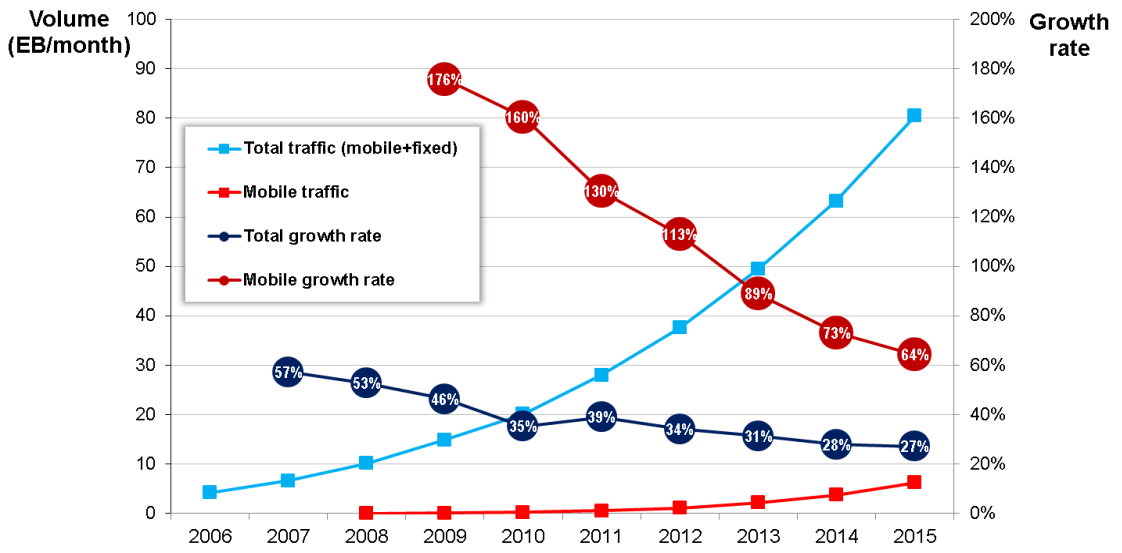
(41) The internet connectivity market has grown from zero to a multi-billion-euro business in 15 years. The majority of the European population use the internet with some kind of broadband connection, and the industry has invested billions of euros in updating the old network and rolling out the new fibre technology in order to provide better services at a lower price to more customers: that is, the industry has produced investments in infrastructure and ensured an ever-increasing bandwidth capacity. In the same period, the industry showed a high level of innovation in content, too. Barriers to entry in the market have been very low thanks to the open nature of the internet. Any content provider – bloggers, website owners, SMEs and large corporations – for a relatively low level of investment to buy a domain name, rent space on a server and implement its application or software, has had the opportunity to test its ideas and their relative value in the marketplace. As a result, new services have been made available to users: browsing, mailing, P2P, instant messaging, VoIP, videoconference, gaming online, video streaming, etc. This development has taken place mainly on a commercial basis without any regulatory intervention.

(42) Mirroring the market evolution, the traffic conveyed on networks has been increasing continuously. In 2011, worldwide IP traffic, according to Cisco's estimation, stood at 30.7 exabytes per month and outstanding growth rates are expected in the coming years. Overall IP traffic is estimated to increase nearly threefold by 2015, to reach 87.3 exabytes per month. Cisco forecasts a slowing down of the annual rate of growth of IP traffic to 21 % in 2015. For Europe, the annual growth rate of international bandwidth usage levelled off to approximately 50 % in 2010.

(43) For mobile data traffic, the rate of growth is higher than for fixed data traffic. However, this is particularly because the increase in mobile traffic starts from a significantly lower level. In 2011, mobile had a share of approximately 2 % of total IP traffic. Although the growth rate for global mobile data traffic was about 152 % in 2011, it is expected to decline to 64 % in 2015.[5]

[5] WIK-Consult (2011, pp. 31-32) based on Cisco and WIK calculations.

Figure 1: Global IP traffic developments



Source: Cisco, 2012 (Visual Networking Index).

(44) In parallel with market developments, rapid and incessant technology innovations that characterise the sector have enhanced the transformation of the internet 'ecosystem' and the interaction between the various economic entities operating there.

(45) The basic feature of the internet 'ecosystem', from its outset, has been the best-effort paradigm. The term 'best-effort delivery' describes an electronic communication service in which the network does not provide any guarantees that data is delivered or that a user is given a guaranteed end-to-end quality of service level or a certain priority class. In a best-effort network, all users obtain best-effort service, meaning that they obtain unspecified variable bit rate and delivery time, depending on the current traffic load. By default, unless instructed otherwise, best-effort delivery networks treat all user service requests (demand for network capacity) equally, irrespective of their nature or content.

(46) Nowadays, traffic management techniques allow ISPs to manage traffic more extensively and precisely and to differentiate the packet routing, depending on the techniques used, based on content, applications, transport/access services and users. In general, traffic management allows for a wide range of operations, each highly heterogeneous, such as, inter alia, the construction of fast lanes (i.e. traffic classes) for certain types of data (so-called prioritisation); the provision of guaranteed network capacity to specific users; prevention of access to illegal content; authentication of customers; blocking of viruses; or the ability to block or degrade certain content. Taken together, traffic management offers potential benefits to stakeholders and may contribute to enhanced social welfare (e.g. by managing/reducing congestion); on the other hand, traffic management may be used to implement strategic practices, using restrictive techniques – to the benefit of the operator but, in some cases, to the detriment of users (or at least a part of them).

(47) Furthermore, internet applications are becoming more and more diverse and starting to demand specific requirements depending on their features (for example, real-time

applications). In general, relevant parameters in the internet experience are, inter alia, the bitrate or throughput (the amount of data transmitted in a unit of time), delay, jitter (time variation of the average delay) and packet loss ratio. According to the type of application, some of these parameters assume particular relevance and become biting constraints in the service provision. For example, P2P quality depends mainly on the effective bitrate available, whereas delays in packet transmission may be tolerated with minor effects on the P2P quality; therefore, it is classified as a capacity-hungry application. Vice-versa, the quality of a VoIP call, being a real-time communication application, relies on the minimisation of mouth-to-ear delay. As far as applications relying on internet capacity require different transmission characteristics and the quality perception of users depends on the application performance, operators could need to implement traffic management tools to allow these new applications to appear and grow (discussed later in this report). It is also a fact that VoIP applications offer good speech quality based on ordinary best-effort transmission despite the claim that specific traffic management may be needed for real-time applications.

2.2 Value chain

2.2.1 Retail players in the value chain

(48) The abovementioned market developments and technological innovations have been shaping and modifying the commercial relationships between the different actors in the internet value chain.

(49) In the value chain described in the document, three major economic entities are active (see Figure 3):

- Internet service providers (ISPs) or internet access providers (IAPs), namely network operators (including fixed and mobile network operators, FNOs and MNOs) and virtual operators (including resellers and mobile virtual network operators, MVNOs), which provide internet access services to users, as well as other intermediary operators or business connectivity providers. ISPs/IAPs are paid for their traffic services by CAPs or users.
- Content and applications providers (CAPs). CAPs offer a wide array of activities such as content aggregation and search engines, messaging applications, entertainment and transactions, and include different players such as over-the-top, media companies, right-holders, users that generate content and even ISPs. CAPs are paid for their services by their users and/or by advertisers.
- Users[6] who purchase access to the internet by IAPs and use (free or paid) content and applications provided by CAPs. The user can be either a consumer or a business user. Users derive utility from the consumption

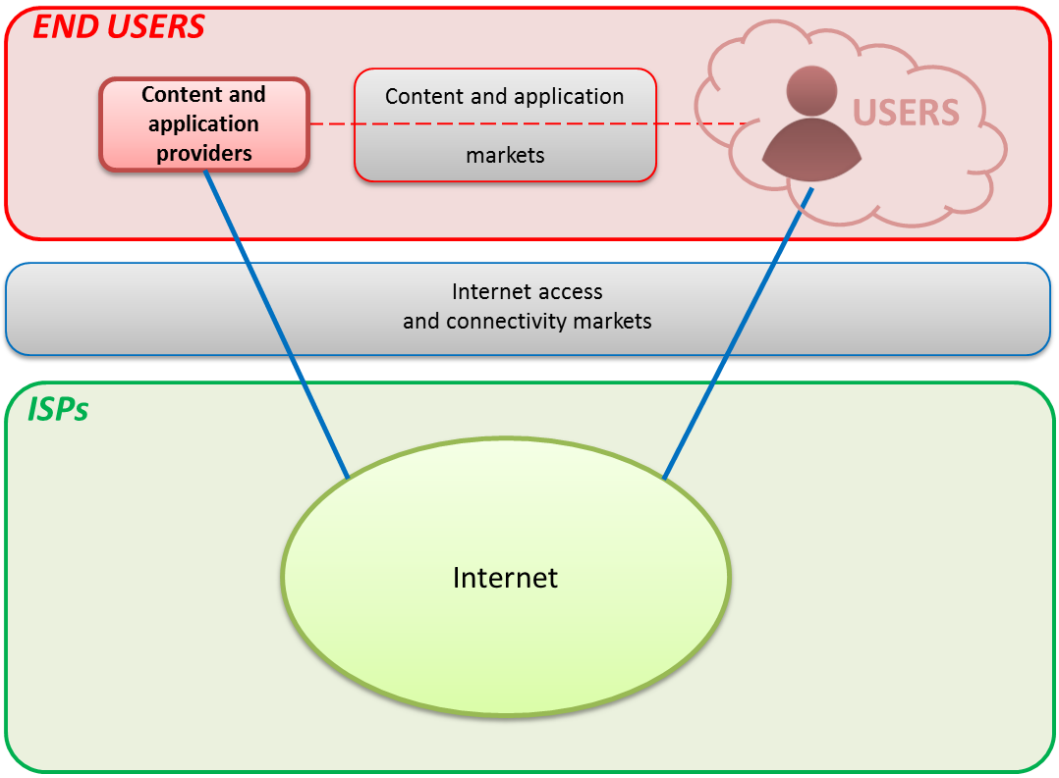
[6] The definition adopted in this document could be, in some cases, more restrictive than the definition included in the Framework Directive, where an *"end-user means a user not providing public communications networks or publicly available electronic communications services"*. According to this definition, CAPs could be considered as end users. However, in this report, for the aim of clarity, we have restricted this concept to any legal entity or natural person using or requesting a publicly available electronic communications service through retail internet access markets not including CAPs.

of two complementary goods: connectivity paid for and provided by the IAP, and contents provided by CAPs[7] that may be free of charge or paid for.

(50) Manufacturers of devices, software and hardware solutions also play an important and ever-increasing role in the internet access market because, among other things, they are interested in developing new solutions and new equipment to facilitate the dissemination of data services. However, the impact of the ICT sector is outside the scope of this report, which it is focused on the issues related to the net neutrality debate that may arise from the behaviour of electronic communications services providers.

(51) The interaction of these economic entities leads to the delivery of services to users who (i) purchase access to the internet by ISPs and (ii) use (free or paid) content and applications provided by CAPs via handsets, devices and goods produced by ICT manufacturers.

Figure 2: Simplified value chain



(52) In the value chain for the internet as a whole, ISPs have a particular role as a hub. On the one hand, ISPs provide access to electronic communication services to users and, on the other hand, they enable interaction between CAPs and users.

[7] In the BEREC report "An assessment of IP-interconnection in the context of net neutrality", the user in retail internet access markets is defined as a content and applications user, given that the term "user" as defined in Art. 2(n) FD is more comprehensive (as stated above).

ISPs thus play the role of enablers or platform intermediaries, making viable the transactions between users and CAPs.

(53) It must be emphasised that CAPs interact with users on so-called content and application markets, but typically these interactions do not necessarily involve a direct connection and do not involve electronic communication services markets. The physical link between CAPs and users goes through the electronic communication services (ECS) markets with ISPs acting as an intermediary.

(54) The ECS markets around the internet are a complex system where various kinds of players can be distinguished. The abovementioned value chain is intended to represent, in a stylised manner, the main categories of economic agents operating, at the retail and wholesale level, in the digital ecosystem.

(55) Nevertheless, it is clear that digital ecosystem markets are characterised by a plurality of (potential) transactions. In fact, each economic macro-entity identified above encompasses different categories. CAPs encompass content, applications and services available online. Within CAPs, another relevant distinction might occur between internet giants and traditional broadcasters offering their media services through the internet. ISPs may be distinguished between network operators, which provide services on basis of the networks they hold, and service resellers, which provide retail services on the basis of intermediate inputs acquired from network operators.

(56) Such a broad characterisation of the retail value chain – based on three main entities (CAPs, ISPs and users) for sake of clarity – is instrumental for the analysis of potential competition issues on the basis of the general conceptual toolbox provided hereinafter, although further analysis of the value chain may be useful to address specific cases falling within the scope of net neutrality. A more detailed view of these interactions and the underlying contractual relationships is provided below.

2.2.2 Scope of the report

(57) In the questions about 'net neutrality' and differentiation practices, contents and networks are closely tied to each other. This often leads one to a consideration of the whole value chain when addressing the debate.

(58) In the internet ecosystem, operators which convey information over networks are playing a central role because they are the unavoidable link needed by users who want to send or receive information over the internet.

(59) NRAs' remits and powers are focused on electronic communication networks and services, as framed by the European legislation.[8] Consequently, this report deals with the 'network neutrality' debate: it mainly addresses the issues met on electronic

[8] Particularly Directive 2002/19/EC of the European Parliament and of the Council of 7 March 2002 on access to, and interconnection of, electronic communications networks and associated facilities (hereinafter Access Directive); Directive 2002/20/EC of the European Parliament and of the Council of 7 March 2002 on the authorisation of electronic communications networks and services (Authorisation Directive); Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services (Framework Directive); Directive 2002/22/EC of the European Parliament and of the Council of 7 March 2002 on universal service and users' rights relating to electronic communications networks and services (Universal Service Directive).

communication markets and has a close look at internet service providers regarding their role of transmitting information between users.

(60) When analysing the competitive situation of electronic communication markets, NRAs do take into account the content which is conveyed over them, following the policy objectives set by the European Framework, which notably entitle them to ensure *'that there is no distortion or restriction of competition in the electronic communications sector, including the transmission of content'* (Framework Directive, Article 8.2.b) and to promote *'the ability of end-users to access and distribute information or run applications and services of their choice'* (Article 8.4.g).

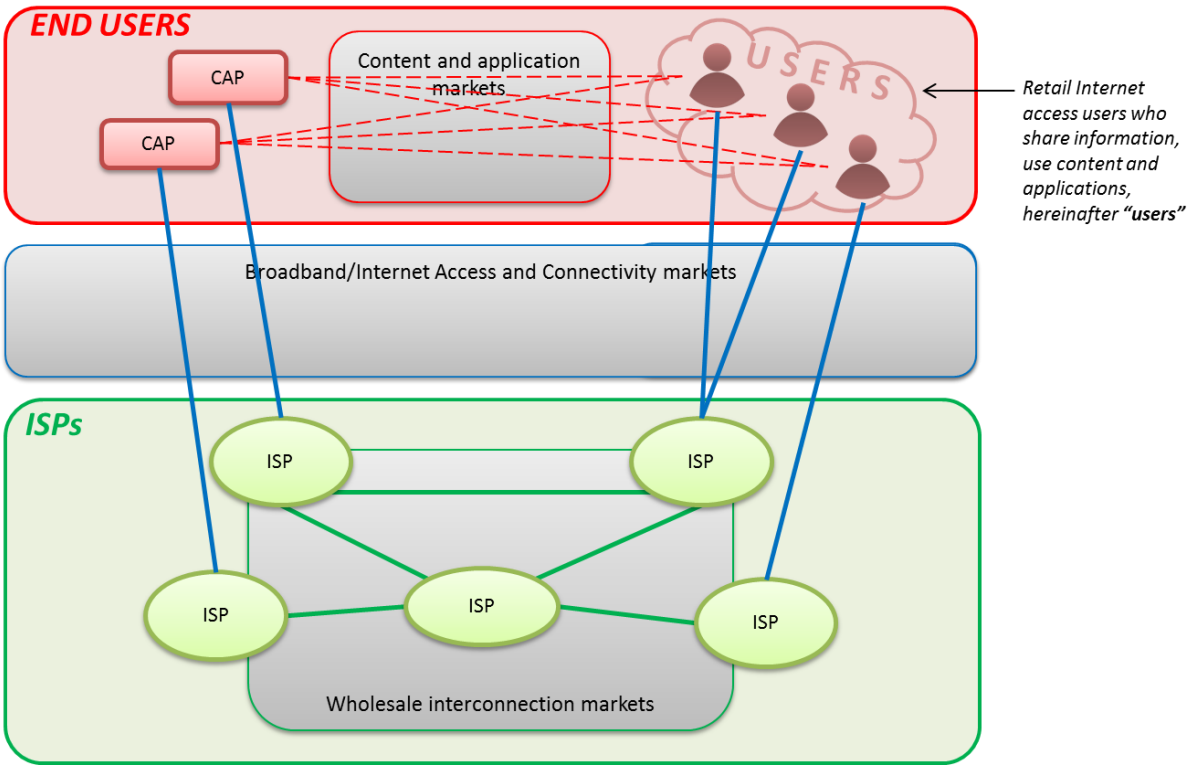
(61) This focus from BEREC and NRAs on electronic communication markets does not mean that other markets, including content and application markets, should be outside any form of scrutiny. Questions and debates arise as regards, for example, fair competition on the online search market (sometimes referred to as 'search neutrality'), or the control that operating systems (OSs) manufacturers may exert on the content and services provided over their platforms (terms and conditions of online applications stores). This could be referred to as the 'digital economy neutrality' debate.

(62) In this regards, it should be noted that the competitive situation of content and application markets is receiving close attention from competition authorities. Notably, the web search market and the specific situation of Google have been extensively scrutinised by the European Commission.

2.2.3 Upstream level

(63) For the sake of clarity in the remainder of the document, it seems useful to introduce a more detailed description of the electronic communication services inside the internet value chain. Figure 3 below identifies players and markets in a schematic way. In this figure, players refer to specific functional roles: even if one person or undertaking generally has one specific role in the value chain and is thus represented at a particular layer in the figure below, it can be the case that they are also active at other parts of the internet value chain.

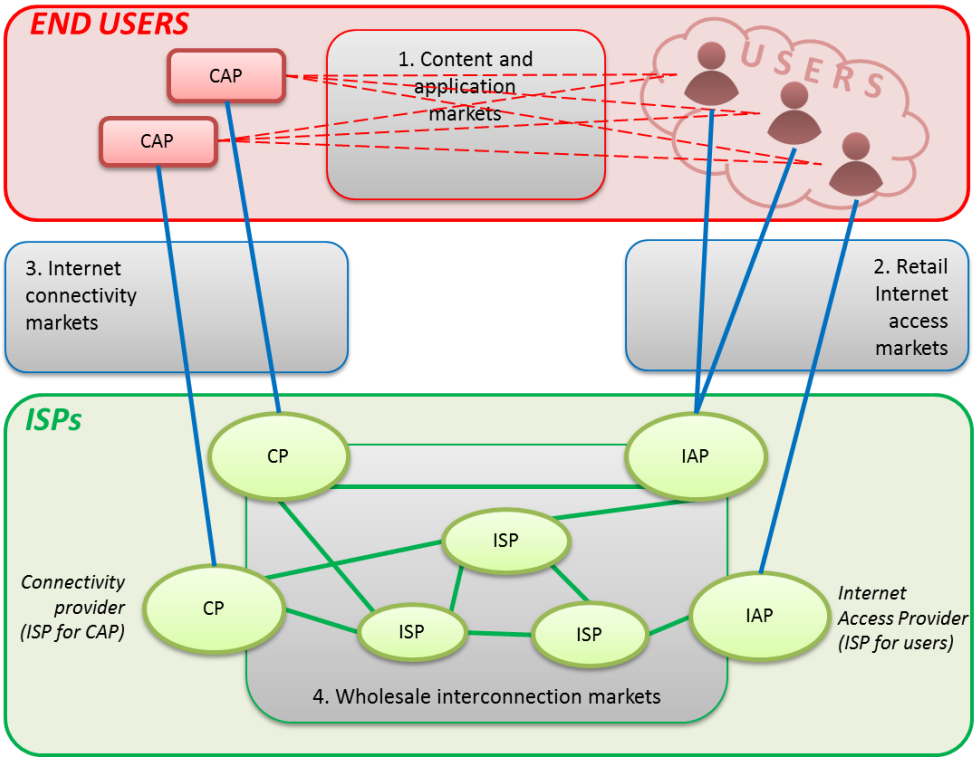
Figure 3a: Description of the value chain



(64) ISPs are actually involved in a number of different product markets, which all come under the umbrella of 'ECS markets' shown in the previous diagram. Each ISP is active in one or several markets, which we propose to distinguish in this report for the sake of clarity and for which we propose the following descriptions:

- IAPs (internet access providers) are ISPs for users, in 'retail internet access markets'.
- CPs (connectivity providers) are ISPs providing services to CAPs in 'internet connectivity markets'. In some cases IAPs and CPs could be the same ISPs.
- ISPs interact with each other in 'wholesale interconnection markets'.

Figure 3b: – Distinction between different electronic communication services and different roles of electronic communication providers in the value chain, mainly for the sake of clarity in this report



(65) Within the IAP category, access network operators (FNOs and MNOs) have traditionally borne the entire high cost of local access infrastructure deployment to provide broadband connectivity and internet access services and have passed this on to their customers (users) through access and usage charges. Similarly, once the access network has been installed, the IAPs upgrade capacity transmission to cope with new customer connections and new traffic requirements arising from new services and applications, and they pass this cost to their customers.

(66) In turn, CAPs offer content and applications over the top of the internet connectivity bought by users from IAPs. Content may be provided either for profit (on a commercial basis) or on a 'not-for-profit' basis. Likewise, content may have a different impact on networks (depending on the technical requirements needed for each type of application) and may belong to different product sectors/markets. In some cases those content/applications can include markets traditionally occupied by network operators (such as voice services).

(67) At present, IAPs are mainly charging users for their internet access, and generally do not charge CAPs, which need IAPs to access the users. This situation has been denominated, by the economic literature, as the 'zero price rule'. However, we consider that this expression could be misleading as it gives the impression that CAPs are not paying for the connectivity services. In the current situation, more often (with some exceptions for some particularly large CAPs developing their own networks), IAPs have no direct contact – and therefore no direct economic relationship – with the CAPs that benefit from those IAPs' networks which enable them to make their services available to users. However, this does not mean that

CAPs are not paying for connectivity services as they indeed do through CPs. For this reason, the current situation could be termed a 'no commercial relation practice'.

(68) ISPs (IAPs and CPs) have to interconnect their networks with other ISPs. Several forms of interconnection exist, which can be broadly categorised into peering (where two networks agree to exchange their traffic, most often for free when they have a balanced interest but sometimes at a non-zero price) and transit (where one network contracts a transit provider to send traffic across the internet).[9] In most cases, ISPs (and particularly the smallest ones) pay for the provision of upstream transit that connects them to the rest of the internet.

(69) While users pay an IAP (on the retail internet access market) in order to access the internet, CAPs will also buy services from one or several CPs on their side of the internet in order to make their content available. That is, users at the 'edges' of the internet each pay for their own connections.

(70) In summary, payments mainly take place at the 'edges' of the internet, which means, generalising, that CAPs just pay their own CPs to make their content available, but do not have to pay the IAPs that have the connection with the user in order to reach their users. Conversely, users do not have to pay the CP that hosts the content they wish to access. This feature has been considered one of the key elements that allowed the fast development of the internet.

(71) At the same time payment mechanisms associated with interconnection markets allow for the financing of the inner networks and operators of the internet, i.e. those who are not directly at the contact of users (or at the 'edges') and do not receive direct revenues from them: operators may pay each other or organise mutual traffic transport by barter transactions, depending on their interconnection agreements.

2.3 Trends and debates

(72) The traditional management, including the pricing structure, of the internet 'ecosystem' is, according to some players, under pressure for a number of reasons.

(73) First, they argue that the demand for data transmission over the internet is constantly growing as a result of the development and the uptake of new applications based on P2P communication, video streaming etc., and ISPs have to cope with this growing demand. In other words, without incremental investment (whose size is nevertheless debated, as it also depends on technical progress, which has been pretty steady over the last years), network capacity may become a scarce good.

(74) Second, it is argued that some CAPs are increasingly using the internet to deliver new applications to users and could be demanding a level of quality that may go beyond the traditional 'best effort' quality of internet access. A demand for quality-differentiated services has always been present and can be met either by a growing supply or by new traffic management practices.

9 BEREC is working on a report "An assessment of IP interconnection in the context of net neutrality" covering qualitative information on the different types of the commercial IP interconnection agreements. This work will continue and the publication of a BEREC Report on IP interconnection is expected during 2012. The analysis of competition and the technological developments of the IP interconnection market may complement the discussion and analysis performed in the present document.

(75) Third, traditional telecommunications providers, cable operators and mobile operators selling broadband and internet access services over their networks are increasingly facing competition from internet players delivering new applications that compete more or less directly with their traditional services. Examples are VoIP, video on demand etc.

(76) Some players argue that the increase of the capacity in the best-effort internet, in order to maintain a simple, efficient electronic communication network, as it has been practised over recent years, remains a valid approach to these developments. That is, demand for capacity can be accommodated thanks to continuous and steady technical progress in electronic equipment as well as new innovative techniques such as content distribution networks (CDNs) and peer-to-peer communication, which would be important contributions to enhanced network architecture for high-capacity best-effort communication.

(77) Others, especially the ISPs that would have to make the corresponding investments, tend to consider that plain and undifferentiated capacity increases (in order to cope with 'temporary' spikes in traffic flow) are not a sustainable answer to these developments, and call for new approaches that raise lively debates; among others:

- an evolution of the best-effort interconnection framework, in order to increase the contribution of CAPs to the financing of the costs of conveyance of the traffic of their services;
- a development of traffic management on their network, in order to offer quality-differentiated or service-segmented offers;
- a development of end-to-end quality of service offerings.

(78) These approaches and the questions they raise are discussed in the following paragraphs.

2.3.1 Best-effort interconnection

(79) Facing the challenges mentioned previously, there may be alternatives to just increasing the capacity in the best-effort internet in order to maintain a simple, efficient electronic communication network. These new innovative techniques such as CDNs and P2P communication can also represent important contributions to enhanced network architecture for high-capacity best-effort communication.

(80) At the same time, the ever-increasing demand for connectivity, the higher level of service quality requirements and the greater degree of competition among ISPs and CAPs may be handled not only at the retail level (at the 'edges'), but also at the upstream level, through interconnection agreements. It is the case that the IP interconnection sector – which is mainly unregulated – has been experiencing a high level of innovation in pricing schemes, in order to confront bandwidth scarcity.[10]

(81) In this respect, it is nevertheless worth pointing out that some CAPs are entering the sector with the scope to negotiate over commercial and technical conditions (including better quality services) vis-à-vis ISPs and transit operators (i.e. the backbone companies that are located at the top-level architecture of the internet, interconnected with lines characterised by higher capacity and speeds, thus allowing efficient transfer of data over long distances).

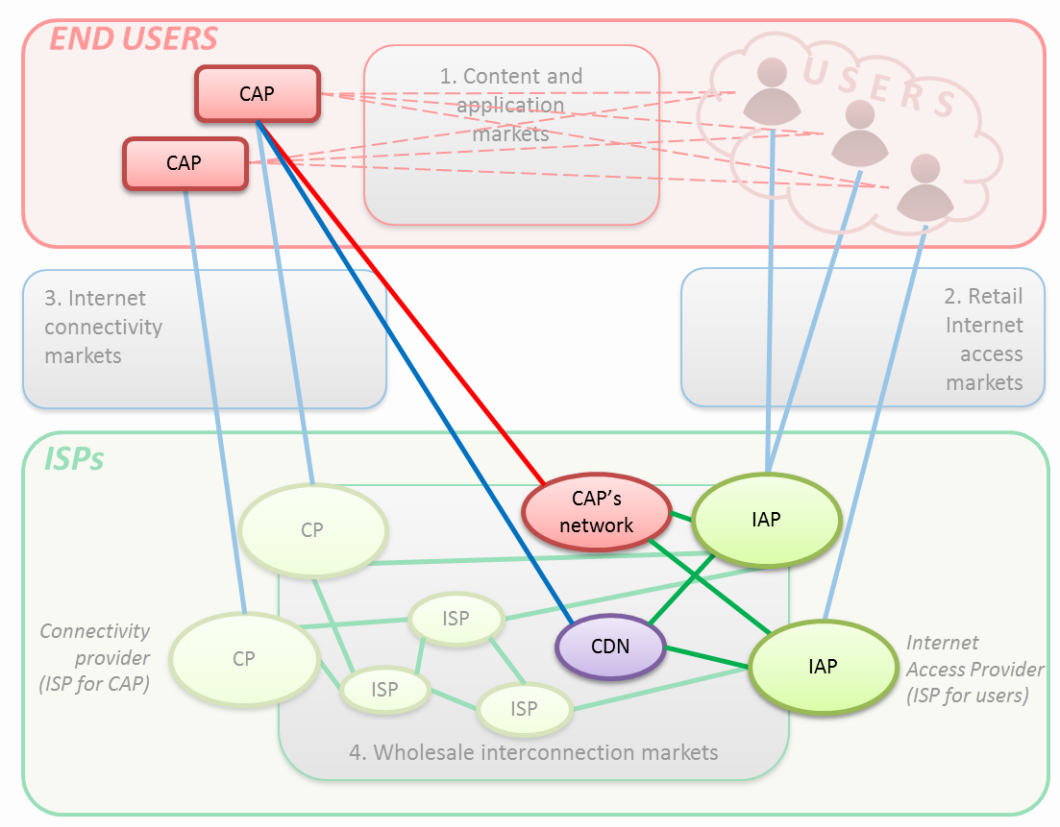
[10] As mentioned before, BEREC will publish a report "An assessment of IP interconnection in the context of net neutrality".

(82) Particular attention has been paid, for example, to CDNs: a system of caching servers that distribute content, thereby creating a virtual overlay network layered on top of the existing IP packet network infrastructure of the internet. CDNs may be deployed over the top but also by deploying infrastructure components interconnected with each other to provide electronic communication services of their own. From an economic point of view, a CDN could be regarded as a reaction to the failure of the classic internet connectivity markets, e.g. transit, to provide sufficient and affordable QoS across networks (from the sending CAP to the terminating IAP and its users).

(83) CDNs offer an alternative for CAPs who have the willingness to pay for better quality instead of relying on contracts with (several) transit networks. In this sense CDNs substitute storage, i.e. local caches, for long-distance networking capacity. CDNs also constitute an alternative for ISPs to using transit services. These multiple relationships are turning CDNs into a 'one-stop shop', reducing transaction costs and exploiting economies of scale and scope.

(84) These developments on CDNs illustrate the fact that some traffic-intensive or quality-sensitive CAPs are actively extending their networks designed to enhance the delivery of their content, either on their own (for the biggest of them) or through specialised intermediaries. This is leading, without specific alteration to current billing models, to a slow but significant evolution of the internet interconnection architecture, from a very hierarchical and pyramidal one (the so-called 'three-tier' model, with tier 1 operators on top) to something more reticular (sometimes referred to as a 'doughnut'). These developments are illustrated in Figure 4.

Figure 4: Evolution of interactions in the interconnection markets



(85) As a consequence, CAPs come into closer and closer contact with IAPs, with fewer intermediaries in between, either only one CDN (CAP only provider, i.e. 'pure CP' ISP), or even in extreme cases none, especially if the CAPs are infrastructure-based network providers themselves. The development of 'pure CP' ISPs, searching for multihoming with as many IAPs as possible in order to provide CAPs with better QoS and save transit costs, changes the bargaining power between CAPs and IAPs and, accordingly, new charging mechanisms may evolve beyond the wholesale (interconnection) level.

(86) BEREC considers these evolutions of interconnection agreements important inside the internet economy and net neutrality debate, but nevertheless beyond the scope of this report. They are not differentiation practices, as long as they do not affect the way ISPs handle the traffic originating from or terminating at a certain CAP or user (in case there is no direct relation between the IAP and CAPs and these interconnection agreements are negotiated with intermediaries, such as transit providers, other ISPs or CDNs). Such wholesale relationships are to be considered outside the issues addressed in this document, and will be analysed further by BEREC in a separate report.[11]

(87) The extent to which direct wholesale interconnection with specific conditions between an IAP and a CAP may resort to differentiation practices should be

[11] BEREC Report "An assessment of IP interconnection in the context of net neutrality".

examined later on, when the BEREC report on interconnection conditions will be available.

2.3.2 Traffic management

(88) Traffic management makes available technical schemes (e.g. access tiering and prioritisation for quality) that are able to deal with the abovementioned issues. For example, specialised services – that is traffic treated in order to provide guaranteed characteristics (e.g. end-to-end quality or security) connected to higher prices – technically rely on traffic management techniques and access restrictions.[12]

(89) In general, as mentioned earlier, traffic management allows for a wide range of operations, each very different. Aside from the construction of fast lanes (i.e. traffic classes) for certain types of data (so-called prioritisation) or the provision of guaranteed network capacity to specific users, it may also allow for the prevention of access to illegal content, authentication of customers, blocking of viruses, or the ability to block or degrade certain content, among other things.

(90) Traffic management practices do not constitute intrinsically an alteration of healthy competition mechanisms or a reduction of consumer welfare. They can be used, on the one hand, for reasons of a general nature (for example, in order to implement legally required provisions avoiding access to illegal content) or, on the other hand, to improve efficiency in resource allocation, e.g. in order to enforce defined fair use policies or allow for the provision of specialised services. In addition, some forms of traffic management have always been adopted by network operators in order to guarantee network integrity, also according to technical harmonisation and standardisation activities conducted internationally. The techniques of traffic management may represent, in certain cases, a more efficient solution as regards the minimisation of costs with respect to the realisation of networks oversized in order to accommodate all the transit traffic suddenly introduced into the network at specific peak times.

(91) However, such practices may also be used by operators to attain, extend or maintain a position of strength in the market – affecting market competition through undue discrimination, degradation or blocking – and ultimately to the detriment of consumers. Without any specific intention to do so, they may anyhow reach similar results because of excessive discriminatory effects.

(92) As they may affect specific kinds of traffic, or the traffic from specific CAPs or users, these traffic management practices may impact the relations between CAPs and the ISP which controls access to users (IAP).

(93) For the most part, these practices will also impact the relationship with the user, in addition to the existing relationship between them for the provision of internet access. As departures from the standard ‘best efforts’ behaviour, these practices amount to the provision to the user of a modified or differentiated product.

(94) Things are somewhat different as regards CAPs, which, in the absence of any traffic management practices, do not have a direct relationship with all the IAPs. Traffic

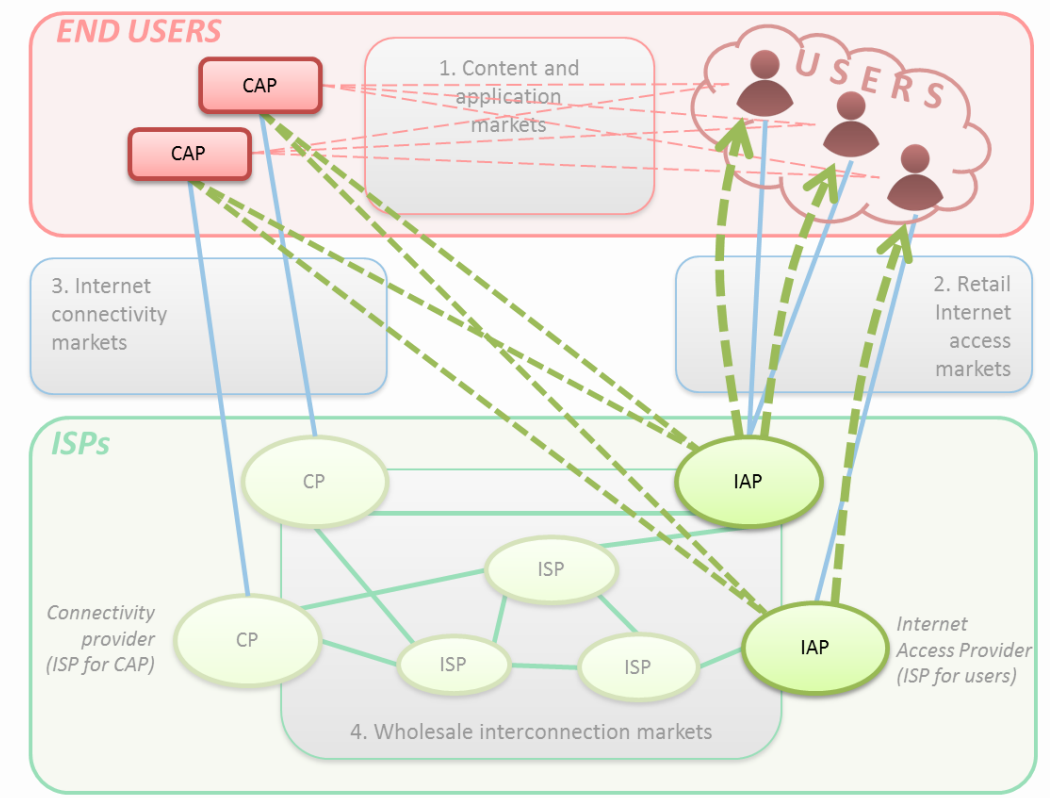
[12] The application of access restrictions is an important distinction between specialised services and Internet access services. Whereas in the specialised case customers’ service requests may be rejected when the capacity limits of a network are reached, best-effort networks, such as the Internet of today, still try to serve the customers (implying a decrease in quality for all users).

management practices differentiating the way 'their' traffic is handled inside the ECP's network could give rise to new relations with the IAP even though the way this traffic is handled over the ECP's network would typically be specified in the interconnection agreement between the IAP and the last technical intermediary that the IAP is connected to. This new relation in parallel with interconnection agreements for traffic conveyance may constitute a significant change from the present 'no commercial relation practice' mentioned previously. As illustrated in Figure 5 below, this would especially be the case where the relationship would be designed to collect new revenues from CAPs.

(95) Figure 5 highlights the relationship that could appear when an IAP implements traffic management which targets the content of a specific CAP (represented by the green dotted lines). As the IAP controls the transmission link between this CAP and its own users (represented by the green arrows), the IAP becomes an unavoidable player for the CAP that wants to enjoy better delivery conditions to these users.

(96) In general, CAPs are not directly interconnected to the ISPs on the users' side (IAPs). Thus, this new relation does not exist yet in the ecosystem as long as there is no CAP-specific traffic management implemented by an ISP. However, it could become more frequent in the future through pressure exerted by blocking of specific CAPs, especially if that blocking can be removed with a payment from the CAP, in the sense of skimming the return of capital.

Figure 5: Interactions induced or impacted by ISP's traffic management practices



2.3.3 QoS interconnection and bandwidth

(97) The two previously mentioned topics (traffic management and interconnection) overlap and may meet in the future, *inter alia*, in relation to the provision of specialised services with end-to-end guaranteed QoS. This would require both a prioritisation of the networks of the ISP, as well as some adapted interconnection, that will allow for inter-network QoS. Standardisation of quality architectures by Internet Engineering Task Force (IETF) that enables guaranteed QoS within individual providers' networks could also be applied to the public internet in the future, with the most challenging aspect being coordination of QoS aspects at IP interconnections between providers.

(98) This would result in an upstream offering of guaranteed QoS interconnection with downstream guaranteed QoS bandwidth, charged for at the interconnection level, allowing CPs or other intermediaries to provide CAPs with end-to-end QoS they would pay for, without the need for CAPs to engage in direct bilateral relations with every IAP. This has, however, been discussed for several years now, and no commercial offers along these lines have been launched so far.

(99) Such potential offerings, being differentiated offerings, would fall within the scope of this document. However, these developments are in their infancy and would require substantial technical, economic and contractual standardisation that is not yet at

hand. Such relationships are to be considered outside the issues addressed in this document, and will be analysed further by BEREC in a separate report.[13]

3 Possible differentiation practices

3.1 Introduction

(100) Broadly speaking, product differentiation, in terms of prices, quality etc., on the supply side, is a competitive factor for commercial activities of a firm in order to make goods and services more attractive than competitors'; dynamically, differentiation is a strategy to adapt product commercialisation to a moving environment. On the demand side, differentiation increases variety of choice. Product differentiation is still consistent with effective competition in a specific market, although successful product differentiation creates a competitive advantage for the seller.

(101) Nevertheless, in some specific cases, differential treatment of traffic on the internet can affect competition, innovation and consumer welfare in general.

(102) It is important to note that it is difficult to conclude a priori that certain forms of differentiated treatment (i) are reasonable or not, (ii) affect competition and innovation and (iii) harm users. That judgement depends to a large extent on the objectives behind the use of differentiation and the effects of this differentiation (examined in this chapter) and on the market structure where these practices take place (examined in Chapter 5). That is why this report does not deal in depth with the techniques used to realise differentiated treatment of traffic on the internet. However, the methods of implementation, and their efficiency and proportionality in regard to the advertised objectives, raise important questions which deserve close attention.

3.2 Objectives and forms of differential treatment

(103) Differentiated treatment of traffic can be done for several reasons and serve a number of different objectives. This section provides some of the motivations for ISPs and network operators to differentiate the treatment of traffic in the telecommunications infrastructure (access lines, transit lines, switching nodes etc.).

3.2.1 Legal reasons

(104) Differential treatment of traffic may be applied to fulfil the legal provisions set in the regulatory framework for electronic communications networks and services (ECNSs). In addition, administrative/court decisions can have an impact on the way

[13] BEREC Report on IP interconnection.

ISPs and network operators deal with the management of traffic over their networks. In such cases the differentiated treatment of traffic is not at the ISP's initiative: it is forced to implement a specific treatment to comply with prescriptive court orders (normally court orders taken on the basis of some specific legislation). Some of the usual legal causes that may lead to traffic management techniques include:

- blocking access to illegal use of content: in some cases, contents available through the internet can be deemed illegal and banned for public access;
- copyright protection: depending on the policy on copyright protection, the availability of some contents may be restricted;
- emergency situations: national regulations could impose priority use of telecommunications infrastructure for security forces, medical personnel etc.;
- lawful interception of electronic communications.

(105) National legislations providing for such measures should be compliant with the ECNS regulatory framework, in particular the new provision in Article 1.3a of the Framework Directive: '*Measures taken by Member States regarding end-users' access to, or use of, services and applications through electronic communications networks shall respect the fundamental rights and freedoms of natural persons, as guaranteed by the European Convention for the Protection of Human Rights and Fundamental Freedoms and general principles of Community law. Any of these measures regarding end-users' access to, or use of, services and applications through electronic communications networks liable to restrict those fundamental rights or freedoms may only be imposed if they are appropriate, proportionate and necessary within a democratic society, and their implementation shall be subject to adequate procedural safeguards*'.

(106) By nature, these reasons are generally considered legitimate and not of an economic nature. However, their implementation should be carefully framed (considering proportionality and efficiency), as their often intrusive nature can have significant side effects. In-depth discussion of these matters is nevertheless out of the scope of this report.

3.2.2 Network security and integrity

(107) Traffic management can also be essential to achieve and maintain network integrity. Different adverse conditions may require routine or specific traffic management techniques to be applied. Some examples of such adverse conditions and responses in terms of traffic management are:

- Outages: transmission or routing elements out of order. In this case, traffic management is applied for automatic traffic redirection and congestion management in order to restore minimum performance levels and/or equilibrate traffic among different elements.
- External attacks: denial of service (DoS), flooding attacks or domain name system (DNS) impersonation. In this case, traffic management is used for identifying and blocking packets coming from suspicious sources.

(108) In general these types of differentiation can be classified as efficiency enhancing since they aim at securing a certain level of performance in terms of security and reliability of the network. The objectives behind it are generally seen as legitimate. However, as with legal requirements, the implementation of such measures should be carefully framed in terms of taking into account proportionality and efficiency.

3.2.3 Congestion

(109) Differential treatment of traffic can also be used to reduce congestion. In general, congestion can have two causes: unpredictable situations that occur on an irregular basis (such as statistical fluctuations of traffic flows or fault conditions within the network) or relatively predicable situations occurring at a regular basis (because of failure to increase the capacity of the network according to the growing traffic load). Congestion may result in high latency, packet loss or blocking of new connections, with potential impact on service availability and on the users' experience. Since the early development of data networks, congestion avoidance has been the prime objective of traffic management. It should be noted that the basic protocols of the internet (e.g. the TCP protocol) are designed in such a way as to reduce the chances of congestion.

(110) With differential treatment, an ISP can selectively limit the bandwidth or throughput of traffic caused by certain types of applications with the aim of reducing congestion. It can do so, for instance, by limiting the throughput of bandwidth-hungry applications such as video on demand or P2P. Conversely, ISPs can also give priority to certain types of traffic to ensure the quality level required for the correct functioning of the application or service in case of congestion. The ISPs also have the option of performing congestion management which will not target specific usage, often referred to as 'application agnostic'. In the different cases, one will need to distinguish between the two causes of congestion described in the previous paragraph.

(111) If differentiations are used, they can be implemented in such a way that they apply only in case of actual congestion ('need based (de-)prioritisation') or in an active way, meaning that the prioritisation or de-prioritisation applies at any time irrespective of the emergence of congestion.

(112) In general these types of differentiation may be classified as efficiency enhancing, since they aim at securing a certain level of performance of the network and may lead to a more efficient use of existing network capacity. The impact on users can, however, be different depending on their use of the internet. For instance, blocking or de-prioritisation of P2P traffic improves the user experience of some users while at the same time worsening the user experience for those who use P2P protocols. On the other hand, non-differentiation in pure best-effort networks results in a 'slim' efficient packet-forwarding technology. Providing sufficient capacity to such a simple network design may give a better cost/throughput performance than a complex architecture based on extensive use of traffic management to implement differential treatment.

3.2.4 Differentiation of services to users

(113) Differential treatment of traffic can be applied by operators to provide performance-specific offerings to clients. Operators could apply differentiated pricing for such offerings while the user could select the contract most appropriate for his/her needs. This practices could involve:

- Limitation of the bandwidth of the internet access under different conditions (permanently, after a download/upload capacity is reached, during busiest hours etc.).
- Different quality levels (normal, premium etc.) for all types of traffic on the internet access service regarding delay, jitter or any other key performance indicator.

- Prioritised delivery for selected type of traffic on the internet access service, e.g. all real-time applications such as VoIP or video streaming.
- Traffic-blocking services, e.g. protection from spam, blocking (limiting) access to specific content such as adult or web sites propagating violence (parental control). ISPs may in those instances offer 'filtered internet access services'.
- Specialised services (e.g. IPTV) providing end-to-end quality of service delivered in parallel with the internet access service.

(114) The forms of differentiation mentioned above can be classified economically as forms of product differentiation on the basis of capacity, usage, quality and content offered.

3.2.5 Differentiation of services to CAPs

(115) This refers to differentiation in the conditions under which CAPs get access to the users connected to a particular ISP. Certain CAPs or certain content or applications services could receive a higher priority or otherwise higher quality while paying a premium rate to the ISP. As a result, this traffic would be delivered faster or with higher quality (in terms or jitter, delay, latency) over the ISP's network than the best-effort quality. Such prioritisation or differentiated quality level would have to be agreed in a contract between the ISP and the provider of such contents/application.

(116) The differentiation would be restricted to the part of the internet that is controlled by the ISP (its own transport network and the access segment connecting the user) and therefore prioritised delivery of content/applications would be restricted to the ISPs network as well. End-to-end quality could be achieved by interconnecting directly between ISPs and CAPs, or possibly in the future using QoS-based IP interconnection.

(117) It should be noted that these differentiation practices can be applied in different ways. They can be applied to a certain type of traffic (for instance video traffic), to certain types of applications (for instance IP messaging applications, VoIP applications) or to certain providers of content and applications. Furthermore, differentiation can be provided as a characteristic of the internet access service itself, or as specialised services provided in parallel to the internet access service.

(118) The forms of differentiation mentioned above can be classified economically as forms of product differentiation on the basis of quality attributes. The economic assessment of these types of differentiation depends on the specific situation. On the one hand they can potentially be efficiency enhancing since they serve a demand for higher quality. On the other hand they can also affect the relative quality available for other CAPs that do not wish to pay for higher quality and this could have a negative impact on overall efficiency. Alternatively, overprovisioning of capacity in a simple best-effort network could be used to achieve high cost/throughput performance, leading to an open network serving all purposes.

3.2.6 Protection of existing business

(119) Traditional services such as voice or TV are more and more being offered on top of internet by specific CAPs outside the control of the network provider. Examples of these 'over the top services' are VoIP applications, IP messaging applications or video on demand services. These 'over the top' services may act as a substitute for

the traditional voice, data or video services of the network operator and may therefore threaten the existing business of a telecommunications provider.

(120) When an ISP is integrated in the sense that it also offers other services to the client such as voice telephony, there is a potential incentive to block or de-prioritise access for users to competing 'over the top' services. In some cases the access to these applications is restricted in the 'standard internet access service' while at the same time it is available at an extra charge in a separate tariff plan. The objective of protecting existing business models can also apply to contents or applications provided on top of the internet which directly compete with the content or applications of vertically integrated ISPs.

(121) Blocking, de-prioritising or charging extra for the provision of over the top services can be classified economically either as differential pricing or as behaviour that potentially results in anti-competitive foreclosure and excessive pricing, depending, among other things, on the position of the ISP concerned in the relevant market. The economic effects of these types of differentiation depend on the specific circumstances under which they are applied.

3.3 Types of effects

(122) In the light of the lively 'net neutrality' debate, this report aims at assessing the impact on users of the differentiation practices described above that are or may be conducted by ISPs providing the users with internet access.

(123) From an economic analysis point of view, differentiation practices are commonly seen as a positive outcome of the functioning of a market, as they tend to increase the diversity of offers on the market and the adequacy of the supply to the demand of the users, resulting in higher welfare for users. Nevertheless, it can be that the functioning of the market results in the implementation of some differentiation practices that have a negative impact. This could happen, in particular, because both the incentives for the ISP and the evaluation by the users do not (or do not sufficiently) take into account indirect effects and medium- or longer-term effects, i.e. externalities or so-called network effects.

(124) In view of these considerations, it appears helpful and useful to conduct a more detailed assessment of the impact of different differentiation practices on the users. Assessing the 'impact' means evaluating whether the implementation of this practice results in an increase, stagnation or decrease of the welfare of users.

(125) As the internet consists of several entities which are linked by various interactions, several direct and indirect mechanisms may have an impact on users' welfare. In this section, we review these mechanisms (or 'effects') in order to set up the list of topics that have to be examined when assessing the overall impact of a selected practice on the user.

3.3.1 Direct (short-term) effects on users

(126) This section is about the effects that directly and immediately impact the welfare of the user.

(127) First, users can be directly affected by differentiation practices. Any measure that changes either price or quality of services delivered to users, which limits or enlarges their choice, which restricts or enforces their ability to use the internet

access service etc. is likely to have an immediate, either positive or negative, impact on users' welfare.

(128) In order to be a concern for the purposes of this report, users need to be harmed by the behaviour; this means that the intensity of the impact should be evaluated. For instance, if an application that did not have very many active users was blocked then immediate impact might be relatively limited. However, the fact that the application has been blocked would have an impact on the ability of other users to ever select this application. A measure that reduces the choice available to users could thus have a negative impact on welfare. The impact of a practice also depends on the number of users that are potentially affected.

(129) As a consequence, the availability of alternative offers allowing for the use of that application (by the same provider or alternative providers), among others, is likely to reduce the impact, as the user may change offer or switch provider. In such a case, the incentives to switch, namely the perception by the user of the negative impact incurred by the blocking, nevertheless have to be assessed against the switching costs.

(130) Beyond these specific effects, one of the internet's strengths lies in network effects: each user benefits from the growing number of users, as it creates new possible connections. Differentiation practices, especially straight blocking, tend to exclude some users from the network, by limiting the proportion of services they can access, and may have a chilling impact on the global community of internet users.

(131) Finally, it should be noticed that the user is not always fully able to determine what specific features he needs from an internet access service, especially on a forward-looking basis. Internet services often evolve; the way they are delivered may be quite diverse even between two services of same nature; and the recommendation of applications or uses by other users is usual.

(132) In addition to these direct impacts, some indirect mechanisms may involve ISPs and CAPs before affecting users.

3.3.2 Indirect (medium- and long-term) effects on users through the evolution of electronic communication services market conditions

(133) This section is about the effects that have an impact on ISPs, either immediately or over time, and that then have an impact on the user in the medium or the long term.

(134) Differentiation practices could be initiated by one or several ISPs which can make new stream of revenues, for example, from prioritising contents (and slowing down others) or extracting value from a content provider by charging it for access to its users. In certain circumstances, these practices might have an impact on competition. A decrease in the level of competition is expected to harm the users' interest, by reducing their choice and possibly allowing higher prices and/or lower quality, while a higher intensity of competition is expected to positively affect users' welfare. Nevertheless, this question of distortion of competition between ISPs on retail internet access markets is neither specific to differentiation practices nor key in the net neutrality debate, as these markets are broadly competitive in Europe and no operator is in a position to extract sufficiently more value from a user to distort competition.

(135) On a longer timescale, beyond an adequate level of competition, a sufficient incentive to invest is needed for ISPs to foster the development of broadband infrastructures (that is next-generation access networks). Differentiation practices,

such as charging users or CAPs for a better quality of service, may help operators to develop their revenues. Insofar as these additional earnings may contribute to the funding of networks (i.e. they correspond to reasonable and sustainable business models covering the costs of the infrastructure) they would have a positive effect on the long-term users' interest which have to be compared with other, possibly negative, effects.

3.3.3 Indirect (medium- and long-term) effects on users through the evolution of content and applications market conditions

(136) This section is about the effects that have an impact on CAPs, either immediately or over time, and that then have an impact on the user in the medium or the long term.

(137) As far as CAPs are concerned, differentiation practices convey the risk of distorting or reducing the intensity of competition between application and content providers. It is generally acknowledged that users' welfare is higher when they benefit from a greater choice. It also has to be noted that the internet's growth and success is largely related to its specificities as an open platform:

- universal connectivity, which means that any end-point of the network can access any other end-point;
- the separation of the network and application layers, which guarantees that all applications are, by default, accessible in similar conditions;

which have the following consequences, among others:

- low entry cost, which allows almost every person or company to start accessing and distributing information;
- innovation without permission and from the edge, which means that new applications can be tested and made available on the internet without any barrier or prerequisite negotiation (so-called *garage economy*).

(138) Furthermore, differentiation practices may have different impacts depending on the size of the CAP. The introduction of different tariffs or technical conditions (e.g. different QoS schemes) could be seen as an entry barrier for some CAPs, such as new and/or small providers and non-profit offers. There is a risk that this may negatively affect users' welfare. Whether or not that is likely to be the case depends on several factors that are difficult to envisage given the absence of concrete examples of this type of practices. For example, it could be that all CAPs would have to pay, in order to avoid too low quality, and this may be a problem for not-for-profit services. On the other hand, an increased contribution to funding from the CAP side could result in lower tariffs set by ISPs for connectivity services delivered to users. It appears that the effect of such practices, which are already partly implemented in some cases, is not easily measurable.

(139) Any practice that challenges these specificities may affect the internet's strengths and may lower (or increase) its interest for users. This question of the impact of the practices of ISPs on the markets of content, applications and services is key in the debate on net neutrality.

(140) From a long-term perspective, the intensity of innovation could well depend on the permanence of the open platform aspects. Dividing the internet into several separate networks, increasing entry costs, differentiating quality depending on applications, introducing innovation control or sending any signal that makes these perspectives credible may make innovation harder and result in a lower growth of new applications.

(141) However, it can also be argued that a reasonable differentiation of performance offered by operators to CAPs could spur the development of quality-dependent innovations. The interest of users greatly lies in the preservation of the internet's openness and neutrality, but allowing a sensible level of differentiation may not necessarily be harmful as long as the performance of the best-effort service is maintained.

3.4 Scope of the analysis in the context of this report

(142) As stated above, the objective of this report is to provide a conceptual framework for analysis of the economic effects of different forms of differentiation on competition, innovation and users' welfare. Therefore the report will focus on differentiation objectives that have a predominantly economic nature. These are: congestion, differentiation of offers to users, providing differentiated services to CAPs and the protection of existing business. These objectives provide broad room for strategic choices based on economic considerations while the remaining objectives ('legal reasons' and 'network security and integrity') are considered important for the operation of a network providing internet access (see above discussion).

(143) To assess the impact on users' welfare, the report will take into account both direct (from the impact of the practice on prices and/or quality) and indirect (from the impact of the practices on the competitive level and future innovation) effects.

4 Conceptual toolbox for the assessment of practices

(144) In this chapter, we set out a conceptual framework for the economic analysis of the differentiation practices listed above. As described in the previous chapter, such practices could have positive or negative effects depending on the market structure. For this reason, it is useful first to discuss, at a broad and illustrative level, how we might characterise the relevant markets where the affected services might belong. The remainder of the section then discusses the relevance of the two-sided platforms theory to the internet and deals with the incentives to discriminate – mainly from the perspective of the IAP – under different scenarios depending on whether there is SMP and/or vertical integration. Such incentives may vary depending on the market power held by the network operator and the services provided; in particular, if the services provided by a CAP compete directly with the services of the IAP.

(145) As we have discussed above, differentiation practices undertaken by IAPs may have a direct effect on internet users but internet users can also be affected indirectly by practices that are primarily targeted towards CAPs. For the purposes of this report the differentiation practices by ISPs that are aimed at CAPs are analysed only to the extent that they may have an effect on internet users (e.g. who may be provided with lower-quality services if ISPs are differentiating between CAPs).

4.1 Characterisation of relevant markets

4.1.1 Introduction

(146) It is useful for a discussion about competition issues related to net neutrality to start with an understanding of the types of relevant markets that could be affected. Therefore, this section builds on the discussion of the internet value chain set out in Chapter 2 and discusses market relationships, which are relevant for the framework set in Section 4.3. This discussion should be seen only as a useful means of better understanding the analysis in the next sections and not as an indication that BEREC believes that these markets could be clearly identified under the European framework.[14]

(147) It is well known that market definition is not an end in itself, but it is part of the process of assessing the degree of market power that a firm may have and, in case the market is part of the regulatory European framework, assessing whether ex-ante regulation is warranted (three-criteria test). As noted in the EC Guidelines on market analysis and the assessment of significant market power ('SMP') under the Community regulatory framework for electronic communications networks and services,[15] there are two main competitive constraints to consider in assessing the behaviour of companies on the market: (i) demand-side substitution and (ii) supply-side substitution. In addition, a third source of competitive constraint on an operator's behaviour is the potential for entry into the market. This differs from supply-side substitution in terms of requiring a longer period of time for entrants to start supplying the products or services that are subject to analysis. Economic agents interact in a given economic market, which has both a product and a geographic dimension.

(148) Below we explore some of the issues related to market definition in the context of net neutrality and differentiation practices. Again, the purpose of this section is not to reach specific conclusions on the definition of the relevant markets but rather to illustrate the sorts of markets that could be affected by differentiation practices.

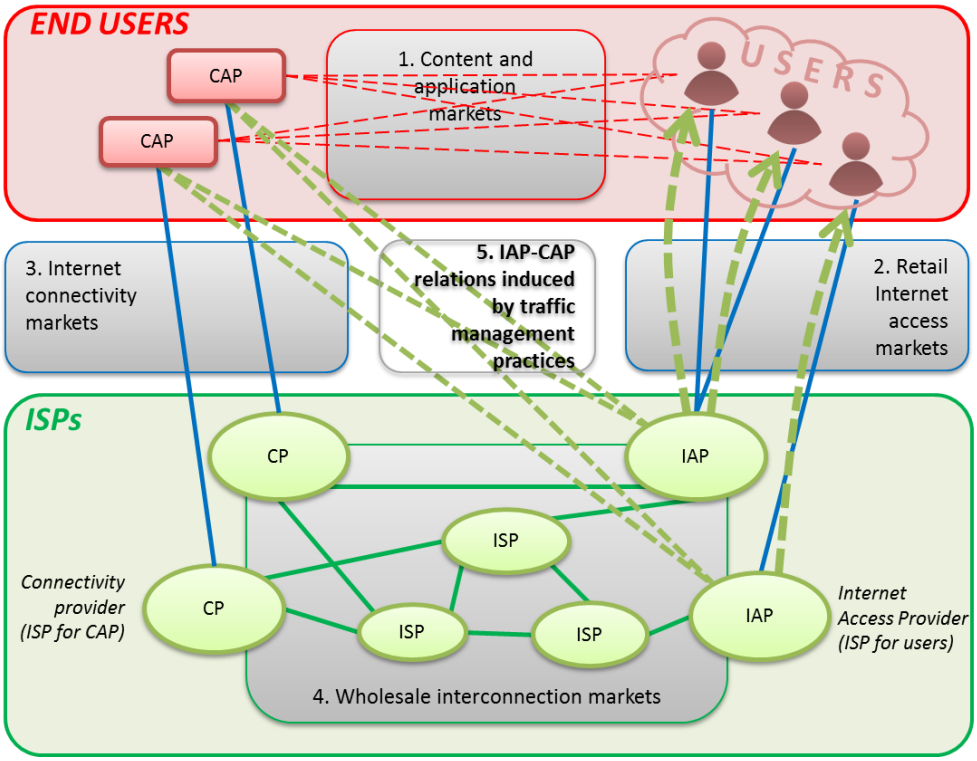
(149) On the CAP side, delivery of content and applications is part of a complex process, in which an important number of transactions (as well as of different services) may be involved before the services are finally delivered to the user via the ISP to which the user subscribes. On the user side, and more important for the scope of this report, is the relationship between the ISP and the customer, which obviously must also be taken into account.

(150) Figure 8 represents the value chain which has already been introduced earlier in the document, with a potential additional relationship between CAPs and IAPs highlighted (the green dotted lines in the diagram). The subsequent discussion is based on this representation of the internet value chain. It should be noted (as stressed throughout this document) that the complex relationships prevailing in the internet ultimately enable the internet user to benefit from the content and applications provided by CAPs.

[14] For instance, much of the discussion which follows is focused on the interaction between IAPs and users at the retail level. We are, however, fully aware that, at this point in time, no IAPs have been identified as having SMP at the retail level (e.g. in relation to retail broadband).

[15] OJEC C165/6 of 11 July 2002.

Figure 8: Detailed representation of the value chain



4.1.2 ISP–user relationship

(151) The relationship between ISPs (or more generally electronic communications providers) and users has traditionally fallen within the remit of NRAs' areas of activity, even if it is the case that retail markets are not typically subject to SMP regulation.[16]

(152) In this report, these ISPs are called internet access providers (IAPs) and grant connection to users on the retail broadband and internet access markets (labelled 2 on the diagram).

(153) Retail internet access can be either fixed or mobile internet access. Fixed and mobile retail internet access have generally, but not in all cases, been deemed to belong to two separate product markets.[17]

(154) At the same time, to fully understand the ISP–user relationship in the net neutrality context, and the differentiation practices that may emerge, it is useful to take into account the services that are being provided over the broadband connection. Such services may include VoIP or content services (such as IPTV or video on demand,

16 As noted in the EC Recommendation on relevant markets, the starting point for the identification of markets is generally the definition of retail markets from a forward-looking perspective, taking into account demand-side and supply-side substitutability. Having defined retail markets, it is then appropriate to identify relevant wholesale markets, which are the ones that are usually subject to ex-ante regulation based on the existence of SMP.

17 See in particular Case AT/2009/0970, where it is concluded that mobile Internet access is, on the basis of the particular circumstances of the case, a substitute for fixed Internet access.

VoD). The exact delineation of the services that are provided via the broadband and internet access connection – and that may be affected by the differentiation practices – will need to be assessed on a case-by-case basis.

4.1.3 CAP - user relationship

(155) Content and application markets cover a range of diverse and complex interactions between providers and users and the boundaries between the different markets can evolve over time.

(156) For example, video content can be exchanged by means of P2P file sharing, streaming or progressive download, which may be partially or completely substitutable. There is also then the issue of the extent to which they are substitutable with other media, e.g. DVDs. It may be that different forms of distribution could form a single, relevant product market.

(157) Most of these content and applications markets are significantly different from electronic communication services markets and are not part of the regulatory framework. In those cases abusive practices of providers with SMP are controlled by the relevant competition authorities. However, some applications do share similarities with electronic communication services and could evolve into electronic communication services over time. For instance, there could be a question about the extent of the distinction between voice and instant messaging services provided over IP.

(158) There will be a need to consider the definition of the relevant content or applications market on a case-by-case basis.

4.1.4 IAP–CAP relationship

(159) The CAPs' business model requires CAPs to purchase internet access as well. CAPs are provided services from CPs or other agents to be able to deliver their content across the internet.

(160) Delivery of content and application services to the user by CAPs is characterised by a broad array of complex relationships, on which basis different economic models may emerge.[18] Most CAPs only contract with a single CP, including transit providers, content delivery networks and some IAPs, in order to optimise their traffic delivery conditions (see section 2.3.1). Nevertheless, their number remains significantly smaller than the total number of ISPs involved in the internet.

(161) What is important for the purposes of this report is to recognize that the relationships by which content and applications services are delivered to the users can be complex. IAPs with which the user has a relationship can be thought of as the last stage in a process by which CAPs, on the one hand, and users, on the other hand, interact (ISPs being intermediaries through which such interactions take place).

(162) Even if most CAPs do not have (at least for the time being and excluding those having their own infrastructure being able to directly interconnect) a direct relationship with the IAP from which the user gets internet access, the IAP is

[18] For a more detailed description of the agreements that are entered into in the Internet ecosystem, see, for example, the Office of Fair Trading's decision of 30 August 2011 regarding the merger between Level 3 Communications Inc. and Global Crossing Limited.

nevertheless providing a service to the CAP, either directly or indirectly, consisting in delivering the traffic originated by the CAP and demanded by the user. On the other side, CAPs provide services to the IAP, as their contents or applications contribute to the attractiveness of the ISP's internet access offer.

(163) This interaction is reinforced when IAPs practice differentiation on a traffic stream that originates from a CAP. This *traffic management practice* involves two parties – either voluntarily or not – which generally have no direct commercial relationship. However, the practice itself may prompt some reaction: either that the practice is not desired by the CAP and that he opposes it, or the CAP requires a degree of differentiation and contracts for it (see section 2.3.2). This could form the basis of relations for differentiated delivery (relation 5) for each ISP, something which may be too marginal to be called a market at this point in time, but could become a sort of a market if these sorts of relationships developed.

4.2 The internet and two-sided platforms

(164) In this section we discuss the implications of two-sided platforms theory for competition analysis in relation to the internet and net neutrality.

4.2.1 Two-sided platforms theory

(165) The spread of new forms of traffic management and the parallel evolution of the internet ecosystem (characterised by continuous growing traffic, diversifying service requirements, increasing competition among different types of agents, and multiple transactions at both the retail and wholesale levels) raise issues related to the allocation of resources among the industry players, and the efficiency of the system.[19] Closely linked to this are issues related to the promotion of innovation and the determination of the incentives to invest, in both content and infrastructure, for the various stakeholders in the supply chain. The literature on two-sided platforms provides a possible framework for interpreting issues of relevance to the net neutrality debate, as already pointed out by the European Commission[20] and Ofcom[21] in 2010, and AGCOM[22] in 2011, in the public consultations held on the net neutrality issue and by academic articles.[23]

(166) A two-sided platform can be described as a platform where two distinct user groups interact through an intermediary or platform. In the internet access market case the

[19] Regarding scarce capacity, the traffic on the Internet has always been increasing rapidly, so that this is not a new situation.

[20] EC European Commission, Information Society and Media Directorate-General, Electronic Communications Policy, "Questionnaire for the public consultation on the open Internet and net neutrality in Europe", 30 June 2010.

[21] Ofcom, "Traffic management and 'net neutrality': a discussion document", 24 June 2010. Ofcom's approach to net neutrality has been further developed in a document published on 24 November 2011.

[22] AGCOM, public consultations nn. 39/11/CONS and 40/11/CONS "Neutralità della rete", 3 February 2011, and n. 714/11/CONS, 20 December 2011.

[23] E.g. Economides, N. and Tag, J., "Net neutrality on the Internet: a two-sided market analysis", NET Institute Working Paper No. 07-45, 2009.

two groups of users involved are (i) users and (ii) agents who produce content and applications for the internet (i.e. CAPs). The internet can thus be seen as the platform over which these different user groups interact, with ISPs acting as intermediaries. The two-sided platforms approach can thus provide a framework for analysing the different economic relationships that exist between different user groups, including platform intermediaries and also analysing competition issues.

(167) The two-sided nature of the internet means that the decisions and market access conditions of one side of the platform will influence what happens on the other side as well. This influence comes from the externalities that each side of the platform generates for the other side.[24] These cross-group externalities are often referred to as a 'network effect'.

(168) In the case of the internet access, the externalities are mainly positive for both sides and derive from the increase of utilisation of the internet platform by each side. That is:

- More users accessing the internet represent more opportunities for generating revenue for the CAPs.
- More CAPs accessing the internet represent more opportunities for accessing more and better content and applications for users.

(169) That said, there can come a point at which there are so many users that there is a negative externality in the form of congestion.

(170) As mentioned above, ISPs (taken together) are the intermediaries between these two groups. The price for internet access and the quality provided to users and CAPs are instruments that influence the participation of each group in the platform. As a result of the cross-group externalities referred to above, the price charged on one side of the market affects not only the participation at that side of the platform but also the other side's participation and vice versa. For instance, if the price charged to users were increased there could be fewer users accessing the internet and, in consequence, the incentive for CAPs to access the internet would diminish.

(171) In the same way, the quality of access (e.g. in terms of speed, delays etc.) affects the range of services that CAPs can provide to users. ISPs may face some pressure from some stakeholders to upgrade their access networks, so that a wider range of enhanced services may be delivered over the internet.

(172) We recognise that the application of the two-sided platforms theory is constrained by the fact that the internet does not consist of a single platform which coordinates price structures to both sides but instead it consists of many networks which hold dynamic and complex negotiations to set prices and which are not fully controlled by any entity. Consequently, we recognise that, in practice, two-sided platforms analysis may not be applicable to every economic relationship that exists between user and agent. In situations where CAPs directly connect to IAPs, IAPs may become closer to double-sided platforms setting prices on both sides. A similar situation may occur when traffic management practices induce a relationship between CAPs and IAPs.

(173) Despite the fact that the two-sided platforms theory does not match perfectly to the current structure of the internet economy, some features of the relations established between the parties in the internet value chain do fit this theoretical framework. It

[24] An externality is a cost (negative externality) or a benefit (positive externality) incurred by a party that was not responsible for the action causing the externality.

can thus help to provide a better understanding of the multilateral connections of market players in the internet economy and its implications for the net neutrality discussion.

(174) Given that internet access could fall under the theoretical framework of a two-sided platforms model, it is important to understand how ISPs have handled two-sidedness and the challenges and consequences of the application of this theory in a forward-looking competition analysis.

4.2.2 Implications of the two-sided platforms theory in the internet world

(175) The fact that until now the IAPs have not charged CAPs, mainly because of the ‘‘no commercial relation practice’ and because IAPs mainly bought their upstream connectivity (as transit) or exchanged it between peers, does not prevent them from applying other tariff schemes in the future.[25]

(176) Charging is already observed between ISPs and CPs on interconnection markets. Some of these players are also discussing QoS-based agreements, which could support new charging arrangements in the context of interconnection relationships. These developments tend to involve ISPs and may affect CAPs only indirectly. However, some CAPs are also developing direct relations with IAPs that relate to the quality of the service delivered to the user. These interactions could lead to more explicit charging arrangements between CAPs and IAPs.

(177) In the light of these developments, it might be possible that in future the socially optimal and the equilibrium prices/quality relationship for a two-sided platform may involve a move towards individual ISPs charging both CAP and users for providing connectivity to content. Developing commercial relations and the emergence of charging arrangements between IAPs and CAPs can represent an optimal outcome where there are two-sided platforms. However, variables such as the relative willingness of each side to participate in the platform, the relative cross-group externalities between users and CAPs, and the transaction costs for implementing pricing arrangements could mean that such charging arrangements do not become widespread.

(178) It is important to recognise that internet access prices for users and CAPs may have important static and dynamic effects regarding innovation in content and applications, as well as in investment in electronic communications networks. Consequently, the change in the internet ecosystem (directly or indirectly by regulation or other means) may significantly affect the incentives for CAPs and ISPs to invest and innovate in, respectively, content and infrastructure (e.g. bandwidth improvements).

(179) However, in general terms, in the absence of regulation and in an effective competitive environment, platform providers will need to take the cross-group effects into account in order to get both sides of the platform ‘on board’, and markets with two-sided platforms could be expected to work well for consumers. In such situations, our initial position would be that such arrangements would be a commercial matter between parties and ISPs and CAP providers should be free to explore new business models. However, we recognise that there could still be

[25] Tariff schemes should be understood in this context as a set of linked characteristics such as price, quality etc.

situations where a platform with market power could end up with inefficient results. Equally, if charges from ISPs to services providers were to become the norm for a wide range of services, this could increase transactions costs and could have an impact on innovation in internet-based services.

(180) Most of these concerns about charging are likely emerge in the context of IP interconnection and its evolution, and so do not fall within the scope of this report. However, these elements will be relevant in the assessment of the possible developments in the 'no commercial relation practice' field.

4.3 Ability to differentiate/discriminate and effects on users

(181) This section aims to provide a general framework or taxonomy for the analysis of the risk of harm to internet users resulting from differentiation practices.

(182) Many of the practices described in Chapter 3 could have both negative and positive effects on users. In fact, often the same practice could have both effects. Therefore, it is important to understand better the circumstances under which concerns may emerge.

(183) The intention is to start by identifying broad scenarios irrespective of whether or not an individual NRA may conclude that there are risks or concerns. These scenarios focus on the different underlying incentives for the IAPs implementing differentiation, i.e. foreclosure, increase profitability, cost reduction etc. There is also the need to take into account the impact on consumers in relation to specific market circumstances to develop a theory of harm that can be evaluated.

(184) We propose to identify broad scenarios by distinguishing between whether:

- there is some degree of market power (specifically 'SMP') or not; and
- ISPs are vertically integrated or not.

(185) Market power is an important factor of our analysis because it can be seen as an indicator of the ability of the operator undertaking a discriminatory practice to affect the market as a whole. Similarly, vertical integration could incentivise an operator to differentiate where the operator is competing with CAPs in the provision of retail services.

(186) Market power has to be assessed with regard to a relevant market. Although it is not the aim of this report to define relevant markets, in a previous section we set out a series of potential markets that could be relevant in line with the relationships identified (see Figure 8 above). As this exercise is solely for the purpose of illustrating particular potential concerns, it is not necessary to extend it to include the geographical dimension of the market.

(187) Table 1 visually illustrates this simple taxonomy and distinguishes between three cases where there is:

- SMP and vertical integration;
- SMP but no vertical integration; and
- no SMP and providers may be either vertically integrated or not.

Table 1: A taxonomy of concerns based on features of ISPs

		SMP? (in retail level (market 2 in Figure 8 above) or in the potential market characterised by the relationship described as number 5 in figure 8)	
		Yes	**No**
Vertically integrated?	**Yes**	Potential exclusionary concerns could arise under a finding of SMP at the retail level (market 2 in Figure 8 above) or in content and application markets or where a firm could behave independently of its competitors in connection with the ISP–CAP relation as a result of the traffic management practices (number 5 in Figure 8 above). We refer to this situation as Scenario 1 in the following sections. In addition, there are also potential concerns about the degradation of best efforts by the SMP operator although the practices may not have the aim of distorting competition.	In this situation there is no SMP operator in market 2 of the Figure 8 above or in content and application markets or the IAP–CAP relation (number 5 of Figure 8). In this case, potential concerns relate to the degradation of best-effort internet and the implications this may have on the incentives to invest and innovate by CAPs (Scenario 3).
	No	In this situation the SMP position is located in the potential market created by the traffic management practices. In this case the main concerns relate to unfair conditions imposed by the SMP operator as a result of these practices with the aim of exploiting its position in the market (through excessive prices). We refer to this situation as Scenario 2. As also in Scenario 1, degradation can still be an issue in a situation where the operator has SMP but is not vertically integrated.	

(188) We will examine each of these scenarios separately, after a brief discussion about market power and vertical integration concepts.

(189) A concern about the degradation of best efforts and its impact on the incentives to invest is common to all situations, regardless of the position of the operator in the

market. However, the impact in the market is logically different. To make this clearer, in Scenarios 1 and 2 we will focus on the specific features of each scenario and discuss the issue of degradation under Scenario 3.

4.3.1 SMP and vertical integration

(190) It is generally accepted that concerns about exclusion of providers may exist when the provider has some degree of market power, which is in broad terms the ability to price above cost.

(191) The market power threshold adopted here is that of significant market power (SMP). A general definition of SMP is the ability of a firm to behave independently from its competitors and users, for example by raising prices above some competitive level in a profitable way for a non-transient period. This is the legal concept used in the electronic communications regulatory framework and by competition law. While there may be a debate about whether SMP is the appropriate market power threshold to identify concerns in the area of traffic delivery differentiation practices,[26] we have taken this as a given for the purposes of this paper.

(192) In a situation in which an IAP has SMP, it could have an incentive to exclude rivals, reduce quality and costs or increase prices, and each of these may harm users. The behaviour may generate both short-run static detriment – i.e. higher prices and less choice for users – and longer-run dynamic detriment – i.e. less investment and innovation. This is because of the exclusionary effect that such behaviour may have.

(193) It is possible that SMP could be established in a number of markets. Some IAPs may hold SMP in certain retail internet access markets.[27] However, it might also be considered useful, in the future, to take into account the IAP's market power when adopting traffic management practices and the potential relationship that could arise with respect to CAPs.

(194) If an IAP were identified as having SMP in a market included in the regulatory framework, the regulator's reaction would be first to focus on addressing the position of SMP directly and so, inter alia, remove the undesirable practice. In general, enssuring effective competition is the most appropriate way to restrict the ability of the SMP operator to distort competition and harm users. The current regulatory framework provides tools, in particular wholesale regulation, to deal with situations in which the market is not operating in a competitive manner. We consider that, in the first instance, direct action just to prohibit the practice would be a second-best option.

(195) For the purposes of this report, vertical integration refers to the combination of activities that belong to different levels of the supply chain. A classic example of vertical integration is the integration of manufacturing and distribution activities. References to vertical integration should be understood in broad terms. That is, it can refer, on the one hand, to instances of 'pure' integration, whereby the services are provided by the same economic unit, e.g. one single company or a parent–subsidiary relationship (where the IAP is able to exert decisive influence over the course of action of the other party), or, on the other hand, to other forms of

[26] As they result in the modification of small characteristics of Internet access offers which may not be as much subject to full competitive pressure as prices and services.

[27] Although, as we noted earlier, at this point in time, most retail broadband markets have been deemed to be competitive.

integration, whereby through contractual agreements (e.g. exclusive contracts) or other non-structural links the IAP is able to have exclusive or quasi-exclusive[28] access to an input or downstream facility which was being traded in the market.

(196) Consequently, when using the term vertical integration in this report we will generally be referring to the integration of IAPs with other parts of the value chain, namely CAPs. However, the term vertical integration may also be related to the provision of services that, while closely related, do not form part of the same market, such as the provision of telephony and video services by an IAP.

(197) The existence of vertical integration may affect the ability of and incentives for operators to compete in the marketplace. In particular, integration may change the incentives for a supplier to continue to deal with third parties, leading to foreclosure of rivals in upstream or downstream markets (input/customer foreclosure), e.g. by denial of access to inputs or distribution platforms that are essential to operate efficiently in the market. The limitation of the capacity of rivals to have access to essential supplies or markets may in turn give rise to the vertically integrated operator being able to profitably increase price or restrict output, to the detriment of users.

(198) This does not, however, mean that the mere existence of vertical integration will lead to anticompetitive conduct; such a premise would obviously have to be tested against the specific facts of the case.

4.3.2 Scenario 1: IAP with SMP and vertically integrated

(199) The first scenario is one involving differentiation practices carried out by an IAP that has SMP in the relevant market and which affect a service/content that is also being supplied by the IAP. As it has been said above, we refer to market 2, to the content and application markets and to the potential CAP–IAP relation number 5 of Figure 8 above. In this case, the underlying incentive to differentiate may derive from ensuring that the IAP does not face competition in the provision of the service/content, i.e. seeking to exclude competitors. Concerns may also arise from the SMP resorting to other practices, such as degradation of best-effort internet. However, as set out above, only the issues related to foreclosure will be considered in Scenario 1. The issues relating to the degradation of best-effort internet are common to Scenario 3 and are dealt with in that scenario.

(200) In general terms, exclusionary behaviour describes a situation where there is a vertical chain and providers have the ability and incentives to prevent rival providers from reaching users or getting access to an input. In terms of the ‘net neutrality’ debate, IAPs control access to internet users to which CAPs want to provide services.

(201) For example, there could be a situation in which one vertically integrated IAP excludes competing CAPs, preventing them from being able to reach the ISP’s subscribers. This could occur where, for example, an IAP, as well as providing

[28] As a rule of thumb, access to a particular input may be deemed to be quasi-exclusive when it accounts for 80 % or more of the total purchases of the good; see, for example, in relation to non-compete clauses EC Regulation No 330/2010 of 20 April 2010, on the application of Article 101(3) of the Treaty on the functioning of the European Union to categories of vertical agreements and concerted practices, OJ L102/1 of 23 April 2010.

internet access, also offers TV content as a specialised service. It could potentially have an incentive to exclude third party providers of TV content.

(202) As a result of behaviour by the IAP(s), competing CAPs either:

- cannot get access to users (i.e. 'blocking'); or
- can get access but at terms (price or quality) which put them at a disadvantage in comparison with the services offered by the vertically integrated provider (i.e. because of 'throttling').

(203) Under vertical integration there may be an incentive for an IAP to exclude if exclusion led to incremental profits derived from users switching from the blocked application to that of the vertically integrated ISP which outweighed the decline in profits for the IAP because of:

1. the reduction in any 'access charges' possibly received, directly or indirectly, from the excluded CAPs[29] and
2. the fact that a proportion of current users may decide to switch IAPs altogether (in which case the IAPs would also lose any profits from providing connectivity).

(204) In this case, the ability of an IAP to exclude competing CAP, by denying access to users, also depends on the market power held by the IAP. Without SMP, CAPs could opt to provide their application/content service through another IAP and still reach a large proportion of users. In this scenario, the probability that the decline in profits of the IAP due to customers switching to another IAP is greater than the increase in profits derived from customers switching 'service' from the blocked application to the application of the vertically integrated IAP would be higher than if the IAP had SMP.

4.3.3 Scenario 2: IAP with SMP but not vertically integrated

(205) In this situation the IAP has SMP in a relevant market but it is not vertically integrated. In this scenario, the concern is not about the exclusion of rival providers, but unfair conditions levied on CAPs, i.e. through excessive charges to CAPs and/or to users (this is discussed in more detail in section 5.1.4). Again, degradation of best-effort internet could be an issue even if the operator is not vertically integrated but, as set out above, we will address the issue of degradation of best-effort internet in Scenario 3.

(206) The unfair conditions that could be imposed by a SMP operator might have several forms. However, when the aim is not to foreclose competition but to exploit consumers, the most common situation is likely to be imposing excessive prices, where differentiation is used as a tool to increase the overall profitability of the IAP. The effect can be twofold: charging excessive prices to all or most CAPs; or charging excessive prices to all or most users. These practices may occur simultaneously or only on one side of the market, depending on the different demand-side elasticities (and cross-group effects as discussed in relation to two-sided platforms).

(207) As set out above, the existence of an SMP position in the market can be addressed directly by NRAs applying those appropriate remedies. In particular, in the case of

[29] As discussed earlier, this feature is not relevant today, but may be in the future if charging starts to take place.

the retail level (market 2), the tools to enhance competition are already identified in the current regulatory framework and have been analysed in other documents of BEREC.

(208) However, unfair conditions can also affect CAPs and, thus, relate to the net neutrality debate, meaning that they are relevant to this report. There is an argument that a change in the current internet ecosystem, whereby IAP start charging CAPs, could lead to a 'competitive bottleneck' outcome whereby CAPs are charged 'too much' for accessing users even in the absence of any exclusion.

(209) BEREC does not share the view that IAP completely control the access of final internet users and, therefore, have the possibility of behaving independently per se. IAPs are affected by retail competition, fostered by different regulatory measures such as wholesale regulation and transparency provisions. These provisions increase to a certain extent the countervailing power of CAPs which would prevent IAPs from imposing unfair conditions.

4.3.4 Scenario 3: IAP without SMP

(210) A concern that has often been raised in the context of the net neutrality debate relates to the quality of best-effort internet and the capacity available to offer differentiated services. We discuss this issue in the particular context of a scenario of an IAP not holding SMP (Scenario 3), but note that it could also be an issue when evaluating the conduct of an IAP with SMP (Scenarios 1 and 2 above).

(211) So far, internet access has mostly been provided on a best-effort basis. This means that all content and/or applications are treated in the same way and in case of congestion no particular applications gets prioritised. The term 'mostly' is important as there are some exceptions. For instance, some services are offered as specialised services whereby some capacity is exclusively reserved for them, e.g. IPTV offers. In other cases, ISPs manage traffic[30] through their internet access service offers, in part to avoid congestion and in part to smooth traffic at peak time. So far, these represent exceptions to a general 'best effort' approach.

(212) The concern that has been expressed is that if prioritisation becomes widespread then the amount of capacity used to deliver services that are not prioritised – i.e. on a best-effort basis – will be reduced. The result would be a reduction in the capacity available for services that are delivered by best efforts, i.e. those which do not require prioritisation, for example because they are not much affected by delays, and may mean that the quality of the standard service could decline. For example, these services could end up suffering more often from congestion than is the case today. This concern is separate from the market power and vertical integration concerns discussed above. Furthermore, this outcome could emerge in the absence of any IAPs having SMP (or even a lower level of market power) and with or without vertical integration between connectivity and content/applications.

(213) This potential concern is focused not principally on static harm from the potential reduction in quality of the best-effort services, but rather on the dynamic implications that this may have on the incentives for CAPs to invest and innovate. The concern is that a lower-quality best-internet effort may reduce the incentives of existing or new

[30] We recognise that traffic management *per se* does not give rise to particular competition concerns and that a best-effort Internet is likely to require a degree of traffic management.

entrants to provide improved content and applications. This is critically important in the case of the internet given the dynamic nature of innovation on the supply side.

(214) The amended regulatory framework for electronic communications, more specifically the Universal Service Directive, has a new provision (Art. 22(3)) which empowers NRAs to impose a minimum QoS on (a) provider(s) 'in order to prevent the degradation of service and the hindering or slowing down of traffic over networks'. This may be an appropriate tool to address service degradation concerns which may arise even in the absence of SMP.[31]

(215) Nevertheless, we think that it is relevant to discuss some of the issues relating to a situation in which a reduction in the quality of best effort could be a concern; in other words, the economic issues that could be relevant where we observe a reduction in the quality of best effort (countered by an increase in the quality of prioritised services).

(216) If users were able to express their consumption preferences and, as a result, opted for prioritised or specialised services instead of services that relied on best effort, it would seem difficult to argue that the change has harmed them. However, there may be exceptions.

(217) The assessment of harm would be different in the presence of an SMP operator in the market. In that situation, users would be constrained in their ability to choose an alternative source of supply. Therefore, in Scenarios 1 and 2, the concerns about degradation are likely to be higher in that the SMP operator could behave independently of consumers.

(218) Even if there is effective competition, another possible exception could occur where users were rational but did not take account of longer-term effects and opted for prioritised services without taking into account the potential that they and the other users would be harmed because their combined choices would have deterred innovation and, hence, lowered the availability and quality of future services. It may be the case that IAPs also fail to take account of this dynamic effect. Therefore, they could suffer, i.e. in terms of reduced profits if innovation on the internet declined and reduced the value users could obtain from internet connectivity.[32]

(219) Another argument that has been put forward is that currently the internet based on best effort allows all ideas about new content and applications to be tried out. If best effort were negatively affected, innovation in content and applications might also be negatively affected. This argument raises a number of interesting issues. The benefits of having unhindered access is that ideas get tried out and internet users would be the ultimate judges of whether a content or application service will succeed or not. There are, however, some offsetting cons. While it seems true that the best-effort internet allows anyone to put forward new content and applications to be judged by users, it is perhaps unclear whether or not this would generate the best outcome for users in all circumstances. For example, CAPs will not necessarily take into account the impact that their services could have on congestion on the internet; e.g., P2P applications, unless they operate in a short-sighted manner, would have an interest in making a range of promising content and applications available to users. They would also act like retailers of other offers and would initially screen

[31] Specific work on this remedy is being undertaken by BEREC.

[32] For example, they might enter priority agreements with service providers but at the same time aim to reserve part of the capacity for best effort to ensure that the future value of Internet connectivity would not decline.

those content and applications that are worthy of being given priority and those that are not.

(220) Other considerations are relevant in considering whether widespread prioritisation would negatively impact best effort and innovation in content and applications. In the absence of exclusionary behaviour, prioritisation could provide important benefits to users, as highlighted in Chapter 3. For example, it could allow IAPs to provide a better quality of services for those applications that are delay sensitive. It could also allow ISPs to manage network traffic by smoothing peak traffic and to ensure that those users and CAPs who make most use of the network capacity face the correct price signals. Therefore, in order to examine the impact that widespread prioritisation may have on best effort and the impact this may have on the incentives to invest and innovate of providers that rely on best effort, NRAs should also consider the impact of such development on:

1. the ISPs' incentives to invest and innovate in their networks; and
2. the incentives for CAPs that need priority because the value of their services (e.g. gaming is sensitive to delays) and, hence, rely on a prioritised service, to invest and innovate.

(221) This reflects the fact that the value that users obtain from the internet depends on a set of complementary inputs: the quality of their network connection and the availability of content and applications.

(222) Therefore, we consider that differentiation practices could be welfare enhancing as far as they allow innovation in the services and as long as they grant the appropriate provision of certain services sensitive to the quality of the network. However, this approach has to be consistent with the fact that best-effort internet access should be of sufficient quality to support those internet-based services which are particularly dependent on low transaction costs and a large addressable market.

5 Analysis of differentiation practices

(223) The analytical framework presented in the previous chapters suggests analysing a specific differentiation practice (and its presumed capacity to harm competition and users) using a two-step procedure. That is, we start from the description of the service potentially affected by differentiation practices caused by specific forms of traffic management (service characterisation), and we identify (i) the commercial practice under scrutiny (commercial characterisation) and (ii) the relevant markets affected by the practice; then a differentiation practice may be assessed on the basis of whether or not one or more providers have SMP and whether or not IAPs are vertically integrated. Accordingly, the combination of the two main drivers (SMP and vertical integration) results in three scenarios which are likely to be of particular relevance:

- SMP and vertical integration;
- SMP but no vertical integration; and
- no SMP and providers could either be vertically integrated or not.

(224) In this chapter we consider some illustrative examples in which we apply the analytical framework presented above. The purpose is not to provide definitive

answers – these can be reached only in specific cases and examining the evidence available – but to try to identify what are likely to be the key elements of any competition analysis. Set out below are three general cases of potential differentiation practices which we use to explore the application of the three scenarios 1–3 above. These three examples of potential differentiation practices are discussed only in very general terms and there would be a need to take into account the specific market circumstances if one sought to apply these examples to a specific Member State:

- VoIP blocking on mobile internet access service;
- P2P blocking on fixed internet access service;
- differentiation in the conveyance of traffic of CAPs (quality and/or price).

(225) These three examples represent the most frequent violations of net neutrality in a strict sense, i.e. in terms of unequal treatment of different services and/or CAPs, and are discussed with regard to different competitive situations (SMP and vertical integration, SMP without vertical integration, no SMP). Examples were chosen from the retail markets, as net neutrality violations have a direct impact on the quality of retail products on internet access markets and on the welfare of users. So it makes sense to start the discussion at retail level independent of any empirical evidence on whether competitive problem have actually arisen on those retail markets.

(226) According to the data gathered by BEREC, most ISPs offer internet access with no application-specific restrictions. The examples discussed here refer to the most frequently applied restrictive practices found in BEREC's traffic management investigation. To simplify and clarify the discussion it is assumed that the provider applies the relevant practice discussed in all its contracts. BEREC is well aware that in reality providers often offer both restricted or non-restricted products. Specific practices (such as blocking or throttling of P2P traffic or VoIP) more often occur in the mobile network than the fixed network sector.[33]

- Blocking/throttling of P2P traffic is the most frequently reported differentiation practice in the mobile networks. While 58 % are not affected by such restrictions, at least 36 % of mobile internet access users are affected by P2P-related restrictions. The data are not clear enough to enable reliable conclusions to be drawn about the remaining 6 % of users who might or might not face such restrictions. These P2P-related restrictions are applied by 35 % of mobile operators: 25 % to all their users, 10 % to some of them.
- VoIP blocking or throttling has also been reported. While 61 % do not face such restrictions, at least 21 % of mobile internet access users are affected by VoIP blocking/throttling. The data are not clear enough to enable reliable conclusions to be drawn about the remaining 18 % who might or might not face such restrictions. The VoIP-related restrictions are implemented by 23 % of mobile operators, either on all their users (3 % of providers) or on a part of them (20 % of providers).
- On fixed networks, while at least 72 % are not affected by those restrictions, at least 21 % of internet access users are affected by P2P-

[33] For details and explanation on how the data are to be interpreted, the reader is referred to the BEREC document 'A view of traffic management and other practices resulting in restriction to the open Internet in Europe', BoR (12) 30. Restrictions may be enforced either technically and contractually or contractually only. Also, some ISPs apply restrictions to all users, while others apply it to some users only. Often the data on the number of users affected were not fully provided.

related restrictions. This corresponds to 18 % of fixed operators: 15 % for all their users, 3 % for some of them.

- Finally, the differentiation among CAPs has also been included in the analysis as it is one of the elements that have caused most debate. While 75 % of mobile broadband users do not face such restrictions, at least 15 % are affected by measures giving preferential treatment to specific over-the-top traffic. The data are not clear enough to enable reliable conclusions to be drawn about the remaining 10 % who might or might not face such measures. For fixed networks, only 2 % of internet access users face such measures, whereas 97 % are not affected and the situation of 1 % is unclear. Internet acces users in Europe are not facing significant restrictions targeting specific providers (2 % of mobile ISPs are concerned, none of fixed ISPs).

5.1 VoIP blocking on mobile internet access serivce

5.1.1 Service characterisation

(227) The use of VoIP on mobile networks requires that the user have internet access provided by an MNO or a MVNO, using certain handset devices (i.e. smartphones and dongles), equipped with specific applications (software). The bandwidth required for a VoIP call depends on the codec used, ranging from a minimum of about 16 kb/s to 80 kb/s (approximately the equivalent of the capacity needed to download a standard web page), compared with around 12 kb/s required to route the traditional voice call. Delay and jitter are other key parameters for the QoS of mobile VoIP.

(228) Complete migration to the all-IP model (i.e. all customers using VoIP) would require a significant increase in network capacity compared with traditional voice calls. However, compared with the available bandwidth of mobile internet access, the additional capacity used for VoIP services would not be significant. For example, the transformation of calls currently routed by traditional circuit-switched techniques into mobile VoIP calls would require an increase in capacity (and therefore network investments). However, each year billions of minutes are already handled by MNO/MVNO and, although a VoIP call on mobile network, as already mentioned, requires an increase in capacity of around 25–35 % compared with an equivalent traditional voice call, many network operators have already undertaken investment on this scale in order to allow the provision of internet access services on their networks.

(229) Mobile VoIP services can be provided either directly by ISPs (typically using IP Multimedia Subsystem, IMS) or by independent firms specialised in providing over-the-top applications. The former case represents VoIP provided as a specialised service (or ‘managed’ VoIP service, as it often goes along with some form of management of the voice traffic made easier by the fact that the voice provider is in control of the network); the second case represents VoIP provided as an application on the internet.

5.1.2 The differentiation practice

(230) In this case we analyse the hypothetical situation in which an MNO or an MVNO blocks use of VoIP applications by its subscribers over their mobile internet

connection. The blocking relates to access VoIP applications provided through the internet access service and does not involve restrictions of access to VoIP provided as specialised services which a mobile operator may deliver itself over an IP-based mobile network or its existing legacy network.

5.1.3 The relevant markets involved

(231) In this example, we assume that there are (at least) two economic markets involved. The first is in relation to the provision of mobile internet access. The practice of VoIP blocking is considered a differentiation because it results in a restriction of the access to a category of mobile applications. We also assume that this market can be distinguished from the relevant market for internet access at fixed locations by virtue of the specific mobile character of the service involved.[34]

(232) The second relevant type of market we consider is the market for mobile voice telephony. The practice of VoIP blocking affects the possibilities for VoIP providers to offer (potential) substitutes for mobile voice telephony services offered by MNOs or MVNOs.

(233) The assessment of the potential effects depends, among other factors, on whether or not VoIP applications are considered (potential) close substitutes for mobile voice telephony.

(234) In this regard, we may have two mutually exclusive situations. In one case, VoIP applications are (potential) close substitutes for mobile voice telephony. In other words, VoIP and circuit switched calls are in the same product market. Therefore, the effects of this differentiating behaviour are felt in the mobile voice telephony market.[35] Alternatively, the mobile VoIP may not be considered substitutable for traditional voice services, for example given different prices, different voice quality perceived by users or different network conditions (i.e. data handover has a higher probability of being unsuccessful than voice handover, 3G network has less coverage than GSM network etc.).

5.1.4 Scenario 1: VoIP blocking by vertically integrated mobile operator with SMP

(235) Since MNOs and MVNOs all offer bundles of services (including voice telephony, SMS and, increasingly, internet access), in the event that it was deemed that VoIP and circuit switched calls were close substitutes, we also assume that there would be vertical integration between the markets for mobile internet access and the market for mobile voice telephony.

(236) In this theoretical approach, given a finding of SMP, if the market is predominantly served through these types of bundles and unbundled supply does not play an important role, one could assume that the market positions of a mobile network operator (and/or that of an MVNO) on the mobile voice market and on the mobile internet access market are broadly comparable. Thus, a mobile network operator with SMP on the mobile voice market could be deemed to have SMP on the mobile internet access market, and vice versa.

[34] As noted before, we acknowledge that in certain circumstances mobile Internet access can act as a substitute for fixed Internet access when the need of the use is fixed Internet access.

[35] If they were in separate product markets there could be no foreclosure.

(237) In this illustrative scenario we assume that only one mobile network operator (or MVNO) is blocking VoIP and that the operator has SMP in the mobile internet access market.[36]

(238) The motive for blocking access to VoIP on mobile networks is the protection of existing business. By blocking access to VoIP the MNO protects its mobile call profits that would occur as a result of substitution of voice minutes on the GSM/3G network with calls through the VoIP applications.

(239) The effect of the practice is that entry of VoIP providers into the mobile voice markets is foreclosed and the user is harmed.[37] The effects on the user of a VoIP-blocking practice by a vertically integrated SMP operator are thus likely to be severe already from a static viewpoint, regardless of whether such practices may also have a chilling effect on dynamic aspects such as innovation.

(240) An efficiency-enhancing justification would also appear unlikely in this case since – as suggested above – the use of VoIP applications over mobile internet access connections requires only a tiny fraction of the network. It is therefore unlikely that the use of VoIP will lead to congestion on the mobile network, and hence congestion management is not likely to be in principle a justification for blocking.

(241) Blocking can also not be regarded as differentiation of offerings to users since – in the case at hand – the operator is not offering a choice between offerings with and offerings without VoIP access.

5.1.5 Scenario 2: VoIP blocking by a SMP mobile network operator that is not vertically integrated

(242) The incentive to block access to VoIP is likely to depend on whether the provider of mobile internet access is also active on the market for mobile voice telephony and whether VoIP is considered a substitute for mobile voice telephony. In the case where the provider of mobile internet access is not active on the voice market, or in the event that VoIP applications are not considered close substitutes for circuit-switched calls, there is less likely to be vertical integration. This significantly reduces the incentive to block VoIP, and thus reduces the abovementioned concerns of potential foreclosure in the voice markets.

(243) Nevertheless, an MNO that is not vertically integrated and with SMP in the mobile internet access market may still have an incentive and the ability to charge excessive prices, even in the absence of any foreclosure effects. As internet connectivity is an input for the provision of VoIP applications, an MNO having SMP (and that does not provide voice services itself) may charge excessive prices to either VoIP providers or VoIP users, although this behaviour needs further analysis in the mobile market environment.

(244) In fact, the excessive charging practice may take two forms: disproportionate price or infinite price (that is, blocking or no provision). In this context, VoIP blocking,

[36] It might also be the case that all mobile network operators are blocking VoIP. That situation could lead to the finding of collective SMP, subject to the fulfilment of the relevant burden of proof for a finding of collective dominance. At this stage we do not distinguish this as a separate scenario since the type of effects of collective blocking on competition, innovation and consumer welfare would be the same. The severity of these different effects, however, may differ (this is discussed later).

[37] In case of collective blocking this effect may be deemed to be stronger than in the case of individual SMP.

which can be seen as an (extreme) excessive price, implies that the SMP operator does not extract rent from the VoIP provider (VoIP user), as no revenues are derived from blocking itself. Then the presence of VoIP blocking would rather be evidence for substitution (from the supply side point of view) between VoIP and traditional voice services (in order to protect traditional voice call revenues).

(245) With regard to the disproportionate price case (i.e. disproportionate pricing to VoIP consumer or VoIP providers), it can be observed that this practice is not straightforward in the current internet ecosystem, where, generally speaking, no transactions occur at present between the VoIP provider and the MNO, and the internet access market does not generally experience *ad hoc* prices for specific services.[38]

5.1.6 Scenario 3: VoIP blocking by mobile network operator without SMP

(246) If no SMP is found on the market for voice telephony and mobile internet access, it is unlikely that the VoIP-blocking practice by one operator on its own will have a negative effect on the level of competition in the market and on the choices, price and quality provided to users. This is the case especially when – as outlined several times by the Commission and BEREC – offer conditions are transparently published by operators and procedures for switching operators are effective.

(247) It is also unlikely that the practice negatively affects innovation in this scenario, because in the absence of SMP there are enough alternative providers of mobile internet access that compete for the provision of access to innovative applications. This is the case whether or not VoIP is part of the mobile voice market, that is either with or without vertical integration by (some) operators.

(248) Nevertheless, there may still be some competition concerns. The main competition concern is that if mobile VoIP blocking becomes widespread (that is, VoIP is blocked by many commercial offers of one or more internet access providers) then a large amount of users will face reduced choice, and less innovation.

(249) In this case, the VoIP providers would complain that such practices discourage, broadly speaking, the introduction of new voice applications (or the upgrade of existing VoIP applications), to the detriment of users and social welfare.

(250) In fact, if VoIP blocking became widespread, the impact of these practices would be amplified and users with mobile internet access would not have the possibility, even with switching, to make or receive calls through VoIP providers.

(251) MNOs could argue that testing new forms of pricing meets practical needs and is necessary for a business case for broadband and ultra-high-speed networks. In mobile services, to date, the total remuneration was carried out through a model based on the service offered, i.e. based on total revenues derived from voice traffic, by SMS/MMS and, indeed, from internet access. In such a context, characterised by the development of over-the-top mobile VoIP applications, the pricing model for services (and therefore the current business model) could not guarantee the economic sustainability of the offers, requesting a rescheduling in order to face

[38] The pricing structure set by ISPs is usually based on a (flat) tariff whereby a user pays a specific amount of money for a predetermined number of hours or data, there being in general no differentiation on whether the data is actually used for mailing, browsing, VoIP etc. Exceptions may, however, apply, e.g. an operator requiring a specific payment for the provision of specific services such as VoIP.

revenue erosion on legacy voice, needed, *inter alia*, to allow the further take-up of VoIP applications.

5.1.7 Conclusion

(252) VoIP blocking, more frequently found in mobile markets, is mainly motivated by the protection of existing business for vertically integrated operators, which offer both voice services and internet access services. If such an operator has a dominant position in the voice and/or internet access retail market, the blocking has strong effects on users, who have their choice limited, and VoIP providers, who cannot enter the market. From a dynamic point of view, innovation is likely to be affected.

(253) If the operator has no SMP, the availability of non-blocked offers in a competitive market where transparency and easy switching are effective reduces the negative impact of blocking. However, if blocking is implemented by several mobile access providers and becomes widespread, its impact is amplified on both users and VoIP providers.

(254) The unblocking of VoIP may require that mobile operators rebalance their revenues between voice services and internet access. This evolution helps operators maintain sustainable business models, while promoting innovation for over-the-top internet applications.

5.2 P2P blocking on fixed internet access service

5.2.1 Service characterisation

(255) To analyse the impact of P2P blocking on competitive conditions of markets and on stakeholders it is necessary to focus on the application used by the P2P system. This concentration on a special application simplifies the understanding of market effects, as it allows concentration on a single specific market.

(256) For a more detailed understanding of this complex topic, reference is made to the technical description of P2P systems included as an Annex to this report.

(257) For illustrative purposes the case of video on demand (VoD) services distributed via the content distribution network BitTorrent[39] is looked at here (rather than software upload, volunteer computing etc.), as VoD produces high capacity demands. Therefore the IAP may have an incentive to prevent its users from utilising VoD services by blocking this P2P system.

5.2.2 The relevant markets involved

(258) Given that a P2P file-distributing system like BitTorrent is blocked (and this has occurred on some occasions), several markets could be involved. First, the internet

[39] Distributing VoD services via file-sharing bulk data distribution applications is rather a new practice; see, for instance, BBC's iPlayer. Traditionally VoD services are delivered as a unicast connection by using a streaming protocol.

access market[40] is involved, as P2P systems are based on the TCP/IP protocol suite of the transport network and users need to be interconnected through internet access to use P2P applications. The IAP may be tempted to manipulate the users' access line, for instance by port blocking or by analysing the traffic with the help of deep packet inspection (DPI) to detect specific software (e.g. BitTorrent software).

(259) Blocking the traffic of P2P systems used for sharing and distributing files is considered a differentiation since it results in a restriction of the internet access service to a category of traffic generated by specific applications. Therefore, here we assume that the behaviour of differentiation by blocking takes place in the relevant internet access market.

(260) Since the early days of the internet, content and application services have been provided separately from underlying transport and access services. A lot of content and application services (e.g. VoIP services, VoD services) still seem predominantly to be provided in that manner. Only the increased use of DPI, etc. allows access providers to differentiate between applications, e.g. blocking P2P applications.

(261) Second, depending on the application used by the help of the BitTorrent P2P system, different content and application markets are involved. This could, for instance, be a content market providing video on demand services or an IT application market providing software through P2P systems. The practice affects the possibilities for CAPs to offer their content and applications in an efficient way or via an alternative distribution channel that competes against the service offer of the IAP.

5.2.3 The differentiation practice

(262) The popularity of P2P applications is causing significant concern not only for the owners of copyrighted material but also for IAPs by creating problems in network capacity and subscriber management. With P2P applications, users share files and a typical peer serves megabytes of files, causing a shift in the upstream/downstream ratio. On the upstream link, congestion results from a larger number of subscribers using it. Such applications as home working and video conferencing also have a similar effect. However, this is a general trend that is observed in modern internet applications, often referred to as Web 2.0, whereby consumers increasingly produce content and do not only consume content any more. It is therefore a natural change from asymmetric to symmetric access capacity need.

(263) The internet pricing model originated at a time when client-server applications dominated the traffic on the internet. Commercial server operators pay their ISPs for the bandwidth used, who in turn pay their respective providers. Since residential customers rarely operate servers, it was reasonable to assume they generate little upstream traffic, keeping costs low for local IAPs and enabling them to offer flat-rate-priced services. It is argued that P2P content distribution applications might incur traffic transportation costs that the IAP cannot pass on to its flat-rate customers. Residential customers are uploading much more traffic than was originally calculated in the IAP's flat rate but this could instead result in recalculation of the rates or introduction of alternative traffic profiles.

[40] Actual broadband access lines and Internet access services are always marketed as bundles and the great majority of those two products in the market are bundles. Without anticipating any detailed market analysis, broadband access and Internet access are integrated here in the Internet access market.

(264) The basic challenge is, however, the total traffic growth and not the P2P application per se. The P2P traffic could, like, for example, ordinary streaming traffic, create congestion so the IAP might be forced to increase its network capacity to avoid decreasing performance for all his users.

(265) In some cases, there might be a more efficient and less distortive way to achieve the same result: for example, upstream capacity could be limited in an application agnostic manner. In other cases, rather than straightforward blocking, it may be more reasonable to simply throttle P2P applications in times of congestion to the benefit of, for example, time-sensitive applications (although this relies on the critical assumption that the ISP is able to guess the value of a specific traffic to a specific user). Those practices would be considered more reasonable than totally blocking special applications because they induce fewer side effects (e.g. with regard to innovation, consumer interests etc.). if equivalent objectives are achieved, considering also consumer experience.

5.2.4 Scenario 1: P2P blocking by a vertically integrated IAP with SMP

(266) The IAP offering internet access services may be integrated, in the sense sketched in section 4.3.1, providing, for example, VoD or IPTV services as well. This is especially the case if those IAPs are (fixed) network operators running their own broadband networks offering retail and wholesale products. It is not always possible to decide in general whether bundles offered by vertically integrated providers lead to vertically integrated markets (with adjusted competitive conditions), because other players in the market could offer components of the bundle separately. One can doubt that such services as VoIP or other content and application services are predominantly provided in those bundles. As long as unbundled services are of importance (which is the case in connection with VoIP offers or VoD providers), vertically integrated providers do not dominate the market. In this case, competitive conditions in the content market differ from those in the internet access market. The content and application services being subject of differentiation by blocking P2P are no substitutes for the internet access market, where it theoretically could be the case that an IAP has SMP.

(267) The assessment of the potential competitive effects depends on the degree of vertical integration of the IAP and on the application (here VoD services) used by this P2P system. For a finding of SMP one has to analyse the situation in the relevant markets involved.

(268) Assuming that a vertically integrated operator has SMP in the internet access market, it has to be checked if it has SMP in the relevant content and application market too. In content and application markets (in our example VoD services) there seem to be more providers that specialise in unbundled supply of content and applications services, e.g. VoD services. So the competitive situation of these markets may differ from that of the upstream markets. At first sight, it is unlikely that the IAP having SMP on the internet access market also has SMP in one of the content and application markets.

(269) In the example case we look at here, only a vertically integrated IAP with SMP in the internet access market is blocking a special P2P system. IAPs view P2P systems critically because some IAPs see many of the currently deployed P2P applications as competing with their own specialised services (VoIP, IPTV and VoD applications). In either case, P2P systems might potentially diminish such IAPs' market share in the more profitable specialised services in favour of conveying traffic which does not attract extra revenues. Saving network costs might also be a

motivation for blocking here, but this case is discussed under Scenario 2. We consider that the blocked system is a P2P file-sharing bulk data distribution system (e.g. BitTorrent) especially used by users to distribute VoD files. This practice does not directly affect the competitive situation on access markets, because the blocked application hampers the service in the downstream market (content market for video services). The products on this downstream content market are not substitutes for the products on the internet access market. The practice might have a competitive effect on the content market, if it applies only to certain type of contents.

(270) Therefore, as the IAP has no market power in this content market, this practice may not directly lead to foreclosure in the downstream (VoD) market, although in reducing consumer choice it may strengthen its position in the VoD market. Market entry barriers may also increase for independent VoD providers using P2P. The IAP also affects the users in the internet access market, as they are harmed by higher charges in using VoD services in a less effective or cost-saving manner. In so far as depends on its position in the content and application market, e.g. the VoD market, the IAP may be able to leverage market power to this downstream market.

(271) On the other hand, the incentives for this practice are relatively low (potentially strengthening the IAP's competitive position in the VoD service market) compared with the disadvantage of blocking additional applications (relying on the P2P system), as this substantially affects the costumers' convenience and choice. Attempts by the IAP to limit access to internet content by P2P blocking would probably result in the loss of subscribers that prefer unrestricted access. This provides a competitive constraint that limits incentives for such actions. The IAP, even if it is an SMP provider, faces disincentives for restricting access to internet content. In other words, there are some indirect effects potentially affecting the IAP's market power at the access markets. Bearing this in mind, hampering access to VoD services by blocking P2P systems does not seem to be a realistic scenario for a vertically integrated fixed network provider. This might be the reason why those practices up to now have rarely been applied by vertically integrated fixed network providers.[41] If blocking needs to be made transparent this may further discourage IAP from applying this practice.

5.2.5 Scenario 2: P2P blocking by an IAP with SMP without vertical integration

(272) If the IAP is offering only broadband access lines without any additional downstream specialised services, and so is not vertically integrated, there might still be an incentive to hamper VoD services in blocking P2P systems; in this case its motivation for blocking is not to protect its business model by offering its own specialised services. The motivation of a non-vertically integrated provider having SMP in the access markets might be to prevent network congestion and reduce transportation cost. This is especially the case for an IAP running a mobile network which is very cost-sensitive for high capacity needs. Another motivation could be given by the extraction of extra profit from the content side.

(273) If the ISP is a provider of wholesale products too, e.g. bitstream access, it also can block the bitstream-based access lines of alternative competitors' users. In case this

[41] See results of BEREC Traffic Management Inspection.

provider has SMP in the bitstream market its differentiation practice would be a matter of Article 7 procedure.

(274) Furthermore, this practice of blocking a special P2P application (or practising excessive pricing that ends up with the same effect) keeps the IAP's users off addressing capacity-intensive services; however, other capacity-intensive traffic such as YouTube is not affected. It is evident that P2P blocking prevents the user from using services which are not substitutes for the products on the internet access market. This practice does not directly affect the competitive situation in access markets, because the blocked application hampers the service in the downstream market (content market for video services). The products on this downstream content market are not substitutes for the products on the access markets.

(275) As the IAP is not active on this content market, this practice may not directly affect competitive conditions in the downstream (VoD) market, but, in reducing consumer choice and access to this content, barriers to market entry may increase. The IAP, even if it is an SMP provider, faces disincentives to restrict access to internet content, as a significant number of users would not accept this restriction and would change their IAP. The IAP has to consider the trade-off between reducing its network cost and congestion problems by limiting its users' access to internet content through P2P blocking and the loss of those users that prefer unrestricted access; without an SMP, this practice is unlikely to be unprofitable. In other words, there are some indirect effects potentially affecting the IAP's market power at the access markets.

(276) Besides those short-term effects there are long-term effects which seem to be more crucial. P2P systems such as BitTorrent enable fast, efficient distribution of large files by leveraging the upload bandwidth of the downloading peers. These systems dramatically reduce the server loading and provide a platform for scalable content distribution as long as there is interest in the content. P2P systems are organised in a way that allows the creation of decentralised, dynamic and anonymous logic networks. They are efficient in the management of bulk traffic and thus help to save cost. P2P enhancements such as P4P and ALTO also provide techniques that take the network topology into account when selecting peers, which further decreases the traffic load of the IP network. The peers work as distributed caching servers, eliminating multiple downloads of frequently requested content over long-distance links. Low entry barriers in connection with low costs attract niche products, which promotes investment and innovation. Taking into account that the current uses of P2P systems are no longer restricted to content distribution by file sharing – they also include software distribution, scientific computing and telephony services and so on – blocking P2P systems has in the long run considerable negative effects on innovation which weakens the competitiveness of the internet economy overall (this effect applies also to Scenario 1 and, as long as the blocking practice is widespread in the market, to Scenario 3).

(277) It might also be the case that all IAPs present in the access markets are blocking traffic of special P2P applications. That situation might be considered as collective SMP, which is difficult to prove. At this stage this is not treated as a separate scenario since the type of effects of collective blocking on competition, innovation and consumer welfare would be basically the same. The degree of these different effects could differ.

(278) It is likely that those strategies may be successful in the short term, but in the long run ISPs probably benefit directly and indirectly from the innovation and emergence of new services that P2P systems might enable. Perhaps ISPs may find new

revenue sources by offering infrastructure support for successful services that initially develop as P2P applications.

(279) Blocking P2P systems or special applications reduces consumers' choice, restricts their efficient access to capacity-intensive and innovative applications and shields the user from innovation. Thus it reduces the consumer's welfare, statically and dynamically.

(280) In acknowledging an IAP's interest in convey traffic with covered costs, changing the pricing model might be a solution which is less harmful for consumers' welfare. Operators that control several service categories, such as voice, video and internet access, can adjust the tariffs of individual services in order to maintain profitability.

(281) The competitive effects in the internet access market and the effects on consumer welfare are the same as pointed out in the case of vertical integration. Similarly, the practice would have the harmful effect for users of restricting the use of innovative applications to a certain extent. In case of collective blocking this effect is stronger than in case of individual SMP.

(282) The effects on the downstream markets are different from Scenario 1, as the IAP is not active there. So there is no leveraging of market power. This practice could affect competition on downstream markets, as it may reduce demand in content and applications markets, diminishing scale effects with all negative impact on innovation, market entry barriers and others. Moreover, it may affect users with excessive prices for video services.

(283) The selection of some specific application (such as a P2P application) for restriction also raises net neutrality questions for NRAs in situations where blanket (and non-selective) capacity limitations could adequately protect the IAP from congestion problems. A blanket cap has the advantage of targeting excessive users, rather than individual applications that affect all users.

5.2.6 Scenario 3: P2P blocking by an IAP without SMP

(284) As stated above, blocking P2P systems in hindering users' access to VoD services does not affect competition in the internet access market. The relevant applications which might be concerned by the blocking are not substitutable with the products of the access markets. Though no SMP is found in the market, the IAP might have an incentive to block a P2P system. The reasons are the same as described in Scenario 2. The IAP blocks because it wants to prevent traffic congestion and/or save costs. If it also offers specialised services on the content and application market – as an additional motivation – it wants to prevent its offers on the content and application market from being cannibalised. Thus, it reduces also the choices and the quality provided to users.

(285) This practice very rarely affects innovation negatively, because in the absence of SMP there are enough alternative providers with non-blocked access services that compete on the provision of access to innovative applications. This assumes that (i) there is enough transparency so that the users is informed of the restriction and is aware of his precise needs and (ii) the user is able to find unrestricted offers.

(286) This assessment differs if a significant number of providers act in the same way, although no SMP can be identified. In that case blocking of P2P systems might have in the short and long run considerable negative effects on users and innovation, if the following parameters are fulfilled:

- The providers that decided to block are important providers on the market and their number is significant.
- There are market entry barriers, so new firms do not enter the market.
- Users' interest in using this feature is low, or insufficiently high to compensate for the unavoidable hassle of IAP switching (identifying a preferable IAP as regards what remain second-rank characteristics of an offer, ordering the IAP change, possible interruption of service for the switching, increased risk of access failure after the switch etc.).
- IAPs' blocking behaviour is not very transparent.
- The impact of the practice is hard to understand, and not directly related to one specific and delimited use.
- Non-blocking competitors are not so attractive that blocking IAPs risk losing a significant number of users.

(287) In a competitive market those conditions can seldom be found together. Therefore, there are doubts about whether this strategy is successful for non-SMP providers, as they typically face significant competition and a wide range of firms are entering the market. Given these alternatives, access providers that fail to satisfy users' preferences in having access to P2P services risk losing substantial numbers of subscribers to competing access providers. These circumstances limit the risk that internet access providers will attempt to engage in discrimination.

5.2.7 Conclusion

(288) There are a few situations where IAPs might see justification for the practice of blocking P2P applications, especially when the IAP finds strong evidence of congestion or if it bears high variable costs for traffic (of more relevance on mobile markets). In any case, rather than straightforward blocking, to throttle bandwidth-demanding applications only when congestion occurs (restricted in time) in favour of other real-time-sensitive applications would appear to be more proportionate. However, even in those situations, powerful arguments should be provided for any differentiated treatment, particularly when application-agnostic traffic management would appear to be applicable to cope with these situations.

(289) Vertically integrated IAPs may also aim at degrading their competitors' contents or applications which are distributed through P2P. This blocking affects competition in the downstream market (the relevant content market), strengthening the vertically integrated IAP's market position in reducing consumers' choice, so that it can deter innovation if the operator holds SMP in the internet access market.

(290) SMP IAPs, not active in the relevant content market (that is not vertically integrated), may have an incentive to block P2P applications for technical reasons (again congestion).

(291) The reduction of users' choice in restricting their access to services lowers the attractiveness of IAPs in the user market. Therefore there are good reasons to believe this form of differentiation will not be a successful strategy, in cases where broadband and internet access markets face competition. This applies specifically if providers have to declare transparently their practices regarding the restriction of traffic and the blocking of content.[42]

[42] See Art. 20 (2), lit. b, Universal Service Directive.

(292) However, if this practice became widespread, what is not the case yet, it would cause significant concern, by having a short-term impact on users and sending, from a dynamic point of view, negative signals to providers of innovative applications based on P2P.

5.3 Differentiation of services to CAPs

(293) Finally, we deal with one of the practices that have created most debate, though its practical relevance, as empirical data[43] show, is currently relatively low: a differentiation by IAPs of traffic delivery conditions offered to specific CAPs. In general, as stated above, IAPs have until now not charged CAPs, mainly because of the 'no commercial relation practice' and because IAPs mainly bought their upstream connectivity (as transit) or exchanged it between peers. However, IAPs could try to negotiate with some CAPs.

(294) This practice could imply:

- a positive differentiation: the offer of a 'premium' service compared with the current best-effort delivery (e.g. prioritised handling of live video; out-of-cap data delivery);
- or a negative differentiation: a degradation of delivery (e.g. lower priority) to push CAPs to the paid service, to lower the IAP's production costs or to hinder a competitor's service – this hypothetical situation, when it negatively affects a large number of content providers, is referred to in the net neutrality literature as the 'dirt road'.

(295) Impacts on users and CAPs depend heavily on the nature of differentiation and on the transaction costs as well as on the willingness to pay. In particular, positive differentiations may be similar to specialised services, which do not necessarily raise competition problems, as long as they leave enough quality for the best-effort delivery of traffic. They could possibly raise issues about undue discrimination.

(296) Effects also depend on the balance of power between CAPs and IAPs. An IAP which holds a dominant position on its retail market is likely to impose significant negative impacts on its users if it throttles some contents, while it may also gain bargaining power vis-à-vis CAPs.

(297) The likelihood of a 'two-speed internet' is largely unclear today, as most contents and applications benefit from a best-effort delivery on IAPs' networks. The management of quality of service is mainly dealt with at interconnection level, through relationships between CAPs, transit providers, CDNs and IAPs.

(298) In this section, we analyse the situation where CAPs and IAPs directly interact to set how CAP's traffic will be handled on IAP's network. We apply the framework analysis to this case as we have done in the other practices analysed. An important question lies in the IAP's market power.

(299) First, the IAPs are providing delivery data services, either directly or indirectly, to the CAPs as described in section 4.1.4. An SMP IAP has the ability to behave as price maker (and quality maker) with respect to any CAP with which it has a commercial relationship.

[43] See result of BEREC traffic management inspection.

(300) On the other hand, countervailing buyer power from larger CAPs could also be very relevant in the ability of the IAP to behave independently. If the CAP is a well-known brand on the internet, therefore, the users will demand proper access to its contents (for example Google, Facebook etc.). If the users are aware of differentiation practices in a concrete IAP, they will choose those IAPs where these practices are not present. If the CAP is small, its contents will normally be aggregated by transit operators which bring together the traffic of several CAPs. In this case, although the CAP by itself will not have a high power, the transit operator could wield some power vis-à-vis the IAP.

5.3.1 Data delivery differentiation by a vertically integrated IAP with SMP

(301) In the first scenario we deal with a vertically integrated IAP with SMP in a retail internet access market, which differentiates practices in the delivery of data coming from one or several CAPs. Vertical integration has to be widened beyond cases where the IAP is active at different steps of the value-added chain but also to cases where the IAP has reached an agreement with a CAP, such as exclusivity or a revenue-sharing agreement.

(302) A vertically integrated IAP has incentives to discriminate traffic coming from CAPs which provide contents or applications competing with its subsidiary. Users face negative effects, as they have their choices diminished and see the quality of other services deteriorating. They cannot easily send signals to their IAP, which holds market power on the retail market. Competing CAPs, if they cannot benefit from the same conditions of delivery in fair conditions, are also heavily affected. Possibly, they are even unable to negotiate with the IAP which holds SMP and unilaterally decides how to differentially handle traffic. This practice causes high transaction costs as there are no direct commercial relationships. There are only indirect ones via CPs and intermediaries. Given the small amount of unit costs of an internet service, those transaction costs could represent a significant part of overall service cost. So those service costs might have a negative impact on innovations.

(303) If the IAP only positively differentiates its own content's delivery, effects are more limited. However, other CAPs may be unable to have their services handled in comparable conditions if the IAP offers no mutually acceptable conditions for such an improved delivery. This affects user value especially in using content products which are delay sensitive. In particular, the IAP might find leverage in its SMP on retail market to dictate delivery conditions to CAPs. This could raise questions about undue discrimination.

5.3.2 Data delivery differentiation by a non-vertically integrated IAP with SMP

(304) This scenario covers the case of non-integrated IAP with SMP. In this case, the incentives of differentiation involve income maximisation and/or minimising of the IAP's costs, imposing a positive price on CAPs for the delivery data service or differentiating their traffic in a negative manner.

(305) The SMP provider on the retail internet access market possibly gives the IAP a higher influence towards CAPs, as its customers cannot easily switch to competitors. The service they enjoy has its quality largely dictated by the IAP, which behaves independently from competitors. This power on the retail market tends to affect CAPs: negative differentiations or restrictive positive practices could

discriminate against content providers, with no possibility for them to rely on user demand as an opposing force.

5.3.3 Data delivery differentiation by an IAP without SMP

(306) This situation differs from the previous ones in the fact that a non-SMP IAP is supposed to pay more attention to its competitors on the retail market. In these conditions, a negative differentiation against one or several CAPs is less likely, as customers would tend to switch to other IAPs.

(307) For a vertically integrated IAP, a positive differentiation in favour of its own content is very similar to a specialised service. As long as this practice does not affect the quality of other services provided on the internet, it is not detrimental to users but may affect CAPs which do not benefit from it.

(308) The non-vertically integrated IAP could also decide to move from the 'no commercial relation practice' and opt to demand a positive price for the delivery data service to CAPs, or lower their quality. This situation requires extensive efforts from the IAP, which faces competition on the retail market and could see its users leaving it if CAPs decide not to pay the required price and suffer from a lower quality of delivery. Market imperfections and lack of transparency, however, give space for such initiatives.

(309) The same IAP could also offer a higher quality to CAPs at a certain price. As explained earlier, according to the two-sided market theory, charging CAPs is not necessarily inefficient. If this practice is non-discriminatorily open to all contents, it could be argued that it could have a positive effect for both CAPs and users. However, it could also create entry barriers for innovators and application providers who are eager to have their products and services easily available worldwide, but face high entry costs to access the platform under good conditions.

(310) The efficiency of this price increase in the delivery traffic service will depend on the competitive situation in the retail markets, because, if they are not effectively competitive, the incomes gained on the CAP side will not be passed through to the users.

(311) Regarding potential effects of this practice, obviously they depend on the manner in which differentiation takes place. If best-effort services are generally degraded, the effects could be much higher than if the IAPs are offering new delivery services while maintaining a minimum-quality best-effort delivery service. However, if users are aware of the quality offered by their IAP, and the retail market is competitive, even in this last case, the final result could possibly be efficient.

5.3.4 Conclusions

(312) internet openness has produced impressive results which could be challenged if current conditions are changed. However, it could also be the case that the current model is not optimal in the long run with increasing costs that could discourage current and potential agents from entering the market, diminishing future demand for CAPs. Moreover, innovation is also possible on the IAPs' side mainly by increasing investments in networks.

(313) Negative differentiation seems to be unlikely in a competitive market. That is the reason why this practice has seldom occurred up to now. Nevertheless, should it happen, negative differentiation would raise serious concerns.

(314) However, beyond obvious effects on users and CAPs, positive differentiated handling of traffic raises questions about discrimination between CAPs, as some of them may not be able to enjoy the same conditions of delivery as the favoured content, even if they are willing to. Positive differentiation should be open fairly to all CAPs, and left at their choice, to prevent such risks. In this area, minimum QoS requirements could represent an appropriate tool in order to guarantee best-effort access to the internet for users.

(315) The interconnection market makes this openness easier, as CAPs do not need to have direct relationships with IAPs. They both have the possibility to optimise their connectivity and enhance the quality of the service they offer, without involving specific bilateral negotiations.

(316) It is recommended that IAPs do not differentiate their handling of traffic by considering the provider it comes from. Should they perceive the need to operate differentiation, in order to prevent risks of discrimination, practices should be based on broad categories of traffic and involve objective criteria.

(317) The emergence of high entry costs for content and applications providers to have their services delivered by IAPs in good conditions, even if it is not likely today, could cause concern and should be analysed with attention.

6 Conclusions on the effects of differentiation policies on users' welfare

6.1 Introduction

(318) In this document, BEREC has acknowledged the huge benefits that internet connectivity has brought to modern economies in terms of users' access to information, innovation, new forms of sharing information, increasing overall economic efficiency etc. This phenomenon has occurred in less than 15 years, taking advantage of the network effects present in the provision of services over the internet. Connected customers gain access every day to more and more content and applications which, on their side, encourage more customers to get connected.

(319) It is generally agreed that the internet's success is based on its openness and non-discrimination features. The tremendous success of the internet also related to the fact that both ends of the networks carried the costs for accessing the network: users pay for uploading and downloading data to the internet and CAPs pay for hooking their servers onto the net. The direction of payment flows has helped to prevent any stakeholder from exploiting a termination monopoly and gaining rents from behaving like a gate keeper, given that there has been sufficient competition at the retail level.[44]

[44] BOR (10) 24 Rev 1: BEREC Common Statement on NGN Future Charging Mechanisms/Long Term Termination Issues, May 2010.

(320) The iinternet's success has also increased, on the one hand, the total amount of traffic managed by telecommunications operators. Moreover, available forecasts indicate a continuing increase of traffic in both fixed and mobile networks. On the other hand, 'bandwidth-hungry applications' and advanced services require upgraded access networks, which demand investments from ISPs. This has, however, been the case since the origin of the internet and the growth rates are declining as well as the costs per unit, so that the overall costs may increase modestly or even decline.[45]

(321) In this situation, IAPs are undertaking, or may undertake in the near future, several practices that modify the current conditions of the internet, in particular changing the non-differentiated treatment of traffic. The final aims of these practices are diverse, from the fulfilment of legal requirements to congestion management or differentiation of the current services offer.

(322) In this document BEREC has provided a conceptual framework to analyse these practices, applying it to concrete examples. This analysis is based on the potential effects of the practices on users, either directly (through the impossibility of using some services) or indirectly (through, for example, a reduction in alternative choices).

(323) The proposed analysis includes:

- A description of IAPs' incentives to discriminate (largely based on revenue maximisation through their vertical integration or cost minimisation in the absence of any vertical integration).
- The IAPs' ability to perform the discriminatory practices in a sustainable manner in front of possible user reaction, which depends among others on their position in the market.
- Finally, acknowledging the particular features of the internet 'ecosystem', the dynamic and static effects of these practices. As has been said above, owing to the network effects of the internet, any restriction could create entry barriers either to users or, in particular, to CAPs, interrupting this virtuous circle and affecting future consumer welfare.

(324) The above framework has been applied to illustrative practices to test it and try to obtain more general lessons that could be applied in other situations that could arise in the future.

6.2 Criteria to assess effects of discrimination on users in practice

(325) In our framework of analysis we have discussed, first of all, the probability of the described differentiation practices happening. IAPs know that their customers contract their connections to access contents and applications on the internet. Therefore, limiting these possibilities could have effects on their profitability by reducing demand for internet connections, either in general or for one particular IAP, which for instance might have earned a reputation for setting restrictions on certain content.

[45] Plum, The Open Internet – Platform for Growth, October 2011, pp. 18, 42–43.

6.2.1 Vertical integration and foreclosure

(326) For this reason, it is important to understand the rationale behind differentiation practices. The clearest case is the vertically integrated IAPs. In this case, the IAP is providing services which compete with applications or contents on the internet. Thus, it can deter this competition on the content and applications market by degrading or blocking these concrete applications. By doing so, the IAP reduces consumer choice and could maintain prevalent conditions on the service. The paradigmatic example of this is VoIP, where IAPs provide voice calls through the traditional fixed or mobile network, while users could find substitutes on the internet (maybe not perfect substitutes but at least viable substitutes for some types of calls) at lower prices (even for free). This is also in part the case of VoD, analysed in the case related to P2P.

(327) As this differentiation has the aim of foreclosing, the effects on users are high because these practices have both static and dynamic effects. The less the competition, the higher the prices and, in addition, restrictions on CAPs could have effects in the long run of limiting their growth by reducing their potential demand.

(328) In any case, two additional elements should be taken into account when determining the effects of discrimination in the field of vertically integrated operators: on the one hand, the market power of the IAP that undertakes the practice; on the other, the intensity of the practice. These two elements are analysed below.

(329) In an effectively competitive market it is less probable that differentiation practices could be sustained in the long run, because, if competitors identify that such applications are valuable for users, there would be an opportunity to gain market share by eliminating all restrictions imposed by the competitors. Indeed, this has happened in some Member States, where small operators did not block VoIP, which, at the end of the day, forced bigger operators to also open this application on their networks. For this reason, in our framework for analysis, when differentiation practices are undertaken by non-SMP operators, a degree of generalisation of the practice is required to effectively reduce users' choice.

(330) For competition to be a disciplinary force some elements are needed. First, the users have to value the application or content enough to switch and, thus, the IAP must face a competitive pressure by differentiation. Second, the market has to be transparent so the user is aware of the differentiation and can take decisions. Once the decision to move from the current IAP is taken, the switching costs should be low.

(331) The effectiveness of competition and the disciplinary role of consumer behaviour to prevent unfair discriminatory practices are, as some stakeholders have pointed out, an open question. On the one hand, competition and transparency are a necessary condition to prevent such practices, at least regarding the main characteristics of the service. On the other hand, more concrete features of internet access could be insufficiently valued by users, allowing IAP to behave strategically. In these cases, additional regulation could be needed. BEREC is committed to closely monitor market evolution regarding traffic management practices, as the Draft Working Programme for 2013 shows.

(332) In any case, BEREC does not share the view of some stakeholders on the existence of an SMP position resulting from the existence of a bottleneck controlled by an IAP. As stated above, competition in the retail market, fostered by different regulatory measures such as wholesale regulation and transparency provisions, results in some discipline on IAP in their relationships with CAPs.

(333) The second element raised is the intensity. The more restrictive the practice, the greater the effects on users. For example, straight blocking is more intense and, therefore, more harmful than situations where, for example, a set of offers are in the marketplace and in some cases the application is blocked but in others not. In this case, users have still some options to escape from blocking, normally by paying a higher price. In this situation, a closer analysis is needed because, if the IAP is giving the choice to the user, the final aim of the IAP could be fair. For example, in the case of VoIP, higher prices for a non-restricted internet flat rate could be the result of data tariffs subsidised by voice prices, unsustainable if the IAP cannot count on a certain income from voice. Once again, in this case, the more competitive the market is, the fewer the possibilities of unfair prices being charged by IAPs for the unrestricted tariff (aiming to disincentivise its purchase). In general terms, in competitive markets, NRAs should probably not need to deal with the speed and the intensity of this tariff rebalancing between data and voice tariffs. On the contrary, in less competitive markets, this could limit the opportunity for more competition on the voice services.

(334) In conclusion, in the case of vertically integrated operators, blocking or degradation of competing applications or contents on the internet could have a foreclosure rationale behind it, which harms users by reducing current competition and future choices. The effects of these practices are assumed to be greater if the IAP has some degree of market power. On the other hand, these practices might not be sustainable in a transparent market with low switching costs because users could, by their behaviour, discipline IAPs.

6.2.2 Differentiation practices undertaken by non-vertically integrated operators

(335) In general terms, potential differentiation practices could affect content and applications that IAPs are not providing by themselves. In these cases, the rationale behind such practice is either cost reduction (understood in broad terms such as network costs, but also congestion management), or income increase. As has been described above, until now the ‘no commercial relation practice’ has been the general rule between CAPs and IAPs. However, IAPs could have incentives to move away from this practice, and start charging CAPs, in order to increase the total income of their operations. This implies that transaction costs are lower than the potential increase in revenues.

(336) We have analysed the case of cost reductions in the case of P2P. We have acknowledged that IAPs should have the opportunity to, on a non-discriminatory basis, manage their networks to increase efficiency, minimising the resources needed to provide the service and assuring the best deal to all users. It is important to note that congestion has some hidden costs that are difficult to measure, as it affects all users connected to the network.

(337) From a static point of view, a fair traffic management could have positive effects if the market is effectively competitive. In this case, cost savings would be passed on to users in a fair way because competitive pressure at retail level will force operators to reduce prices or increase quality. This result is not necessarily affected by the fact that all IAPs are performing the same restrictions because this parallel behaviour is probably not caused by a joint SMP position but because the underlying reasons (cost savings) are common to all of them. However, the most important issue is that users will benefit from the practices, as competition will assure that the cost savings are passed on to users.

(338) If there is an operator or operators that hold(s) a single or joint SMP,[46] the final outcome is not so clear. Restrictions will be in place with a reduction in costs, but users might not benefit from it.

(339) These arguments are valid only if the restrictions are done on a non-discriminatory basis among all content and applications providers, and under objective criteria such as consumption of resources. In other cases, the rationale behind the IAPS' behaviour could be distortion of competition. In particular, it may be difficult to imagine why the traffic of some concrete CAPs is limited whereas the traffic of others is not, if the only aim of the IAP is congestion management.

(340) As well as non-discriminatory, the practice should be efficient and proportionate to the relevant motivation, in order to minimise possible side effects. Traffic management is not considered, as already stated in this document, intrinsically negative or harmful for the consumers, as it is a useful tool to deal efficiently with objective network problems. Therefore operators have to perform a sort of trade-off analysis between the benefits for consumers of traffic management practices and the restrictions these practices impose. Therefore, when alternative and less distortive practices are available to achieve the same objectives, they would be preferable. Among these alternatives we include, in particular, content- and application-agnostic measures that in some cases could deal in an appropriate manner with the situation at hand without impacting on the consumer experience or the openness of the internet platform for users' CAPs.

(341) From a dynamic point of view, the analysis has several elements to be considered, as there are also positive and negative effects that should be balanced with the ones described above. On the negative side, restrictions will prevent some users from using some applications intensively, or they will even be blocked. This is, for example, the case of P2P in mobile networks. Although, considering the whole market, the outcome could be positive in the short term because of the arguments noted above, the potential demand for some applications will be reduced. This could reduce future innovation and content diversity, limiting future users' choice.

(342) However, it has to be said that this analysis is not straightforward because the NRA has to balance, on the one side, current efficiency benefits derived from effective congestion management and cost savings, and, on the other, future benefits and costs, which are always uncertain.

(343) Differentiation can be motivated by cost savings, but also because IAPs want to increase the income obtained from the connectivity activities. In any event, complaints seem to have been directly related not to concrete CAPs but to ISPs. The analysis in this case is even more difficult.

(344) On the one hand, moving from the 'no commercial relation practice' should not necessarily reduce consumers' welfare. On the contrary, applying the two-sided market theory, it can be even more efficient if the demand of users is now more inelastic than that of CAPs. However, this is difficult to assess, as the CAP side is rather heterogeneous, with big companies existing alongside small CAPs that are unable to connect directly to all IAPs. In this field, the big ISPs play an important role, aggregating traffic and reducing potentially high transaction costs that could arise if this practice is generalised.

[46] As mentioned in section 4.3.1, while there may be a debate about whether SMP is the appropriate market power threshold to identify concerns in the area of traffic delivery differentiation practices, we have taken this as a given for the purposes of this paper.

(345) Moving from the 'no commercial relation practice' raises another problem, which is the price level set at the CAP side. As described in the market definition section, CAPs require IAPs to deliver their content to the user, giving some power to the latter to set the prices. However, a complete analysis is needed first, to measure in an appropriate manner all forces engaged in this process, including the existence of countervailing buyer power in big internet companies, or CPs, which manage huge amounts of traffic from very different CAPs.

(346) Second, NRAs should also consider the sustainability of these restrictive practices as, probably, not all IAPs in the market will be able to move from the 'no commercial relation practice' because of their small size compared with the agents listed above. The pressure faced by big IAPs from the smaller ones mirrors the discussion above, where, as was seen, small operators moved all IAPs – at least in some jurisdictions – to offer unrestricted access to VoIP. Competitive pressure from those IAPs unable to move from the current practices could prevent others from performing traffic management practices deemed to force CAPs to enter into a direct commercial relationship.

(347) In the current situation it is, therefore, difficult to reach a final conclusion on the strength of the forces listed above and the efficiency of the potential final outcome. This will depend on the cost (transaction cost) and the final price level, if IAPs finally opt to move away from the 'no commercial relation practice', and the generalisation of the restrictions observed.

(348) Finally, it is important to bear in mind that this report, for the aim of clarity, has analysed restrictions of individual contents or applications. However, it could be that IAPs opt to restrict or block in broad terms the content accessible by users from their connections. In this case, the above conclusions might not be valid because the final outcome of taking all restrictions together is harming users by reducing the choice available from their connections. This could be especially problematic in an environment where IAPs tend to block or degrade applications or CAPs on a general basis, including when, for example, a particular IAP blocks a specific application or CAP, another IAP blocks a different application or CAP, and so on. In this context, internet current features would be very difficult to maintain; this would affect users' welfare and potentially trigger the need to resort to the QoS provisions recently included in the Universal Service Directive.

6.2.3 Drivers to assess potential effects and available legal instruments

(349) One of the key elements considered is the level of competition observed at the retail level. In this context, NRAs have tools under the current framework to enhance competition and prevent the strengthening of SMP positions. These tools are available mainly at the wholesale level and are related to reduction of entry barriers.

(350) First, if the operator has SMP, as noted throughout the report the main issues of concern may be foreclosure or exploitative pricing by the SMP operator. This could happen on the retail market, even though this is not common any more in European markets. This could also happen in the relation between the IAP and other ISPs and CAPs, although, as stated above, BEREC does not share the view of some stakeholders on the existence at present of an SMP position resulting from the existence of a bottleneck controlled by the IAP.

(351) The current regulatory framework provides tools to ensure that market power is not harming users thanks to the possibility of imposing ex-ante obligations (it being noted in any event that, under said framework, remedies will usually have to be

imposed at the wholesale level). Likewise, in the case of SMP players, application of ex-post competition rules may also be possible (taking into account that the concepts of SMP and dominance should normally be aligned). The boundaries of the market definition exercise to be undertaken by regulators or competition authorities in order to prove the existence of SMP/dominance are in any case beyond the scope of this report.

(352) The other aspect that could affect the sustainability of restrictive practices is consumers' awareness of such practices and their ability to exert pressure on the IAPs by their purchasing decisions. For this force to be effective a high degree of transparency (with understandable information for users) is needed. In addition, the possibility for users to switch in an easy, fast and cheap manner is also essential. Otherwise, users will not be able to exert sufficient pressure on IAPs and, in the same way, alternative IAPs will not see the unrestricted access as an advantage to compete in the market.

(353) Fostering competition by manner of using these existing pro-competition tools as well as increasing consumer awareness through better transparency should be the first action of NRAs as regards net neutrality concerns.

(354) BEREC has already been working regarding potential means to increase transparency in the market. However, it has to be acknowledged that these tools may not always be sufficient, as internet access is a complex product, and differentiation practices may be second-rank characteristics of the offers (as international roaming tariffs have proven to be before as regards mobile telephony offers), not significant enough to trigger a user to switch in the face of switching costs that will never be zero, but nevertheless inducing significant side effects for users.

(355) Finally, when retail competition is not enough to grant an adequate output for users (which does not need to be exactly the same as the one observed today), NRAs have different ways to deal with specific behaviours of the IAP.

(356) In particular, the revision of the existing Directives has granted additional tools to NRAs in the form of minimum quality requirements, which could – on the basis of the decision taken by the NRA considering the particular circumstances of the case – be applied to operators, independent of SMP in the retail market.

(357) Resorting to QoS provisions appears to be an effective action in a situation where, even in the absence of SMP, discriminatory practices that do not have any legitimate objective and fair rationality become more frequent.[47] In this case, users' connections may be degraded by such practices and future innovation might be discouraged. Application of the QoS provisions could also be relevant in the presence of SMP operators, as a complementary remedy to pro-competition tools, taking into account that the practices undertaken by the SMP operators could be those that have been deemed particularly detrimental to the development of competition, in particular in instances of foreclosure.

(358) However, imposing minimum quality requirements should come only after a thorough analysis of the practices and their situation in the context of a market,

[47] The mediation by NRAs in conflicts arising between electronic communications operators and CAPs may also be an option, on a case-by-case basis, when on the basis of national law NRAs have been granted the possibility to intervene to solve such cases using dispute settlement procedures.

which are detailed in BEREC's *Guidelines for Quality of Service in the scope of Net Neutrality.*

(359) This Report has shown that traffic management cannot be evaluated in general terms, as the same practice can imply an unfair discrimination or not, depending on the context. This calls for a case-by-case assessment, on the basis of the criteria that have been highlighted in this report. In the same sense, the available tool has to be chosen on a case-by-case basis, as the most effective tool has to be tailored to the situation of the market.

ANNEX

P2P characterisation

(360) There are two fundamental systems of network communication

- a client-server model and
- a P2P model (client to client).

(361) In the client-server model a number of clients are connected to the network in order to access a central machine, a server. The network is designed to fulfil the communication needs. There are a number of organisational server units connected to the network where a lot of traffic is terminated/originated whereas the majority of network end-points (clients) generate a comparatively low amount of traffic.

(362) In a P2P model there is no hierarchical distinction between server and clients. All communication partners have equal rights, i.e. they are peers. A P2P program (software) installed on the user's computer is needed to construct a community of P2P application users. Thus it creates a virtual network between these users. Those individuals form a loose group and each member can communicate with another member without the control of a central instance (a server). They can, for example, share files from their local computers and download files shared by other users.[48] There are dozens of different P2P applications, and each one acts a little differently.

(363) This section will look specifically at P2P systems which are the basis for specific P2P applications.

(364) The music download system Napster[49] was one of the first services to use the P2P system successfully.

(365) In the meantime P2P technology has gone far beyond music sharing, anonymous data storage or scientific computing. It is now a matter of significant research attention and increasingly the subject of widespread use in open software communities and industry alike. Scientists, companies, and open-software organisations use BitTorrent[50] to distribute bulk data such as software updates, datasets and media files to many nodes. Commercial software allows enterprises to distribute news and events to their employees and customers. Millions of people use specific services to make video and phone calls, and hundreds of TV channels are available using live streaming applications.

(366) The most successful P2P systems are used for:

- sharing and distributing files;
- streaming media;

[48] The recent challenge of peer-to-peer systems for file-sharing by services which offer users the ability to share files through centralised servers, without relying on an underlying P2P infrastructure, are not directly addressed here as they just can be seen as another (client-server) web service.

[49] Napster was based on the P2P principle, but the service used a central server for index-linked lists of music files on the users' PCs. It helped to recognise where to find which sort of data. The real transfer of the file was managed peer to peer.

[50] A. Bharambe, C. Herley and V. Padmanabhan, *Analyzing and Improving a BitTorrent Network's Performance Mechanisms*, available at http://research.microsoft.com/en-us/um/people/padmanab/papers/infocom2006.pdf

- telephony;
- volunteer computing.

(367) In the report, sharing and distributing of files are discussed as an example. Here, most popular applications are file-sharing protocols (such as eDonkey, user-organised content distribution with a content search component or, for example, BitTorrent bulk data distribution for a predefined set of content). File sharing allows users to share their files with other participants, who are able to search for keywords in the file names. Other users would then download any of the files directly from the peer who shared it. There are successors of Napster (Gnutella, Fast Track or its client applications such as Kazaa) which, unlike Napster, are not organised in a centralised manner and are not operated as a single entity.

(368) The desire to reduce the download time for very large files led to the design of BitTorrent,[51] which enables a large set of users to download bulk data (predefined) quickly and efficiently. In a P2P system such as BitTorrent, peers not only download content but also provide it to other peers. The system uses spare upload bandwidth of concurrent downloaders and peers who already have the complete file or parts of it to assist other downloaders in the system. Unlike user-organised file-sharing applications, BitTorrent and other P2P content distribution networks do not include a search component. The search component is, however, provided either as a separate system or as a combined distribution and search system. Users downloading different content are unaware of each other, since they form separate 'networks' (so-called swarms). The protocol is widely used for dissemination of data, software or media.

(369) Important parameters of a P2P system are a high degree of decentralisation, self-organisation, abundance and diversity of resources, and multiple administrative domains. There are distinctive characteristics of P2P systems which determine their (economic) value:[52]

(370) The deployment costs are low because P2P systems require little or no dedicated infrastructure, because P2P systems use existing user hardware resources and user network connections. The upfront investment needed to deploy a P2P service tends to be low in comparison with client-server systems. This causes a low barrier to entry in special services markets.

(371) The virtually decentralised network structure allows organic growth. The participating nodes contribute to the resources. As long as the user and its ISP provide sufficient infrastructure resources, a P2P system can grow almost arbitrarily large without requiring 'high-level' investments in infrastructure.

(372) There is resilience to faults and attacks in P2P systems, because there are few if any nodes that are critical to the system's operation. To attack or shut down a P2P system, an attacker must either target a large proportion of the nodes simultaneously (attack on terminal equipment the application is running on) or target the traffic flows generated by the applications (attack within the network).

(373) If an ISP wants to block specific traffic, irrespective of whether it is client-server or P2P traffic, a filtering function is needed.[53] This function is normally located at the

[51] For more information on the network performance mechanisms see Bharambe et al. above.

[52] Rodrigues, Peter Druschel, Peer to Peer Systems in Communications of the ACM, No. 10, 2010, available at http://cacm.acm.org/magazines/2010/10/99498-peer-to-peer-systems/fulltext

[53] The discussion below on filtering criteria can also be extended to other services, such as VoIP services.

service access point of the ISP. In order to block traffic each IP packet has to be investigated. Based on a set of criteria, the packet is then dropped (or, in case of traffic shaping, queued). Filtering criteria are, in principle, based on the following kinds of information:

- destination and source IP address of the packet;
- protocol used as indicated by port number (by the application);
- content data (payload) of the IP packet.

(374) The first two filtering criteria (according to destination and source IP address of the packet or the application protocol used) are related to the investigation of so-called header information of the IP packet, whereas the last one involves in-depth inspection of the payload, i.e. deep packet inspection (DPI). Besides the fact that DPI requires a lot more processing resources at the node, it is commonly seen as a critical means of filtering because privacy issues are involved. So, in most cases, filtering is performed only with respect to IP addresses and protocols used.

(375) Given the nature of P2P traffic, the easiest way to prevent the user from using a specific type of application (e.g. file sharing, VoIP) is to block the traffic based on the protocols typically used by these applications. These measures involve the detection of the so-called port number stored within an IP packet. The combination of the IP address and port number identifies the end-point of a communication. This end-point is application or process specific. If traffic sent to or received from this end-point is blocked, the application cannot communicate any more and thus is blocked.

In order to block a specific application of a specific company, additional information (e.g. destination address, traffic pattern, content) is normally required, since the protocol used by this application may be unknown in advance, dynamically changing and also perhaps used by other applications. Regarding P2P applications, the destination and source addresses are multiple and will usually be dynamic and unknown in advance. In these cases DPI is often involved.